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RESEARCH ARTICLE

Motor dysfunctions in preschool children with Autism and its functional implications in life

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Abstract:

Background: Neurodevelopmental disorders (NDD) comprises of highly heterogeneous group of diseases characterized by impairments in cognition, communication, behaviour, and motor functioning as a result of atypical brain development. Standardization and development of guidelines for motor phenotyping of the motor abnormalities inASD, has not got enough attention when compared with their behavioural and developmental counterparts. Hence, the need for this study by which we can determine the common motor abnormalities sothat they are corrected at the earliest.

Methods: A Cross -sectional study was conducted for a period of 10months after enrolling a total of 60 children in between age group 3-5 years of age who met the inclusion criteria by convenient sampling method. After entering their demographic details in the proforma, diagnosis was made using DSM-5 criteria and standard diagnostic tools and all ASD's were selected. All the children were subjected to PeabodyDevelopmental Motor Scale (PDMS -2) assessment to assess their gross motor and fine motor functions, and then WeeFIM was administered to assess the extent of functional impairment in their daily activities. 1-sample Binomial test was used to analyse WeeFIM and PDMS-2 scores in each subset in the total sample. Correlation between each subset in PDMS -2 and WeeFIM in the total sample and then only ASD children was done by using t -Test, Levene's equity of mean, C hi -square test.**Results:** In the present study 41 out of the total 60 (68.3%) ASD children were found to have motor impairments as seen by the Total Motor Quotient which was in the range of below average, poor and very poor in PDMS -2. Among the gross motor the commonest subset affected was object manipulation (34/60) 58.3% followed by locomotion(48.3%) and stationary (46%) whereas, in fine motor domain

the most affected subset was visual -motor integration (35/60) 58.3% followed by grasping (35%).Among all NDD children the functional significance was assessed by WeeFIM which revealed self-care and cognition domains as the most affected and even though the gross motor functions were the most affected still it did not affect functional mobility of the child . ASD and all of these children had motor impairments as seen on PDMS -2 and in theday to day activities the most affected subdomain was eating followed by grooming and bathing in the self -care domain.**Conclusion:** Hence in NDD's like ASD where motor dysfunctions are not overtly present, if any functional impairment is present, we need to assess both the fine motor and gross motor dysfunctions in detail with the help of a standardized tool; find the domains interfering with functional abilities and take the necessary corrective measures, so that we can improve the day -to-day functioning of the child.

Keywords: Autism, PDMS, Functional assessment, Motor dysfunctions, Developmental delay, Speech delay

Introduction:

Neurodevelopmental disorders (NDD) encompass a highly heterogeneous group of diseases characterized by impairments in cognition, communication, behaviour, and motor functioning as a result of atypical brain development. Motor dysfunctions of predominantly non-motor neurodevelopmental disorders (NDD) such as autism spectrum disorder (ASD), Attention deficit hyperactive disorder (ADHD) etc. have been traditionally a neglected topic in both clinical practice and research. Even though, motor delays and impairments are not a core diagnostic feature in children with autism spectrum disorders (ASD), they are still present in majority of individuals with ASD. [1]. Most of the available standardized measures assess the motor milestones and skill acquisition but they often fail to capture more qualitative or subtle differences in overall motor function. Like all other neurodevelopmental domains (such as cognition or social skills), a better assessment of the full spectrum of differences and impairments in motor skills would serve to shed light on specific neural mechanisms of atypical development as well as provide more specific targets for motor -based interventions which, could result in improvement in other core features of ASD. [2] For example, rather than quantifying whether a child is able to walk between 2 points, better information can be obtained if evaluated to see if the gait is wide based, rigid, or asymmetric implicating the different underlying mechanisms. Since, motor function is a common intervention target, accurate measurement to individualize therapy improves the overall outcome. Standardization and development of guidelines for motor phenotyping of the motor abnormalities in ASD, despite its pervasive, variable nature and importance, has not got enough attention when compared with their behavioural and developmental counterparts.

Hence, this study was conducted to determine not only the motor dysfunctions which were commonly associated with the ASD but also the extent of functional disability that these motor dysfunctions will cause in the day-to-day living of these children between 3-5 years of age.

The objectives of this study were to:

1. To identify the various motor dysfunctions which are associated with ASD in children between 3-5 years of age.
2. To determine the extent of functional disability that these motor dysfunctions will cause in the day -to-day living of these children.

Materials and methods:

Study design:

A Cross -sectional study was conducted in Saveetha Child Development centre(SCDC) and 3 branches of Vistara Child Development Centres (VCDC), Chennai and Hyderabad for a period of 11 months. Study was started after getting the ethical committee approval (No.-SMC/IEC/2019/1/003). A total of 60 children in between age group 3-5 years of age who met the inclusion criteria were enrolled, convenient sampling method was used to select the sample size. Children suspected to have developmental disorders, delays or high risk are referred from Pediatric OPD to SCDC and those with speech and behavioural problems referred to VCDC were enrolled. Children were assessed by a multidisciplinary team consisting of Developmental Paediatrician, Developmental therapist, speech therapist, Occupational therapist and Clinical psychologist.

Children aged between 3- 5 years of age referred to CDC and those with Primary ASD with a normal routine CNS examination were included into the study. Sample size was estimated at 60 considering the lack of exact prevalence of motor disturbances in ASD in India. Children below 3 years and above 5 years of age and children with motor NDD such as Cerebral Palsy, Pediatric stroke, Children with metabolic or known genetic and syndromic causes were excluded as prognosis in these disorders vary significantly from Autism Spectrum disorder. Their demographic details were entered in the proforma, diagnosis was made clinically using DSM-5 criteria and CARS-2. Participant's information sheets in English and local language was provided to the parents and the need of the study was explained to them along with reassurance regarding safety and confidentiality of their data as the principal investigator signed an agreement ensuring the same with one copy retained by them. All the children who were part of the study underwent Peabody Developmental Motor Scale (PDMS -2) assessment. This test was used to assess the gross motor and fine motor functions, and then Wee-FIM was administered to assess the extent of functional impairment in their daily activities. Presence of any major or subtle motor dysfunctions was identified and quantified by a qualified Pediatric occupational therapist and Principal investigator together using PDMS-2[3] Test for each subscale, was administrated from the starting point defined by the chronological age of the child (entry point), as per the instructions given in the manual. Some items required a verbal request, whereas others required verbal request with the demonstration of the action. Physically helping the child to perform the required test was not allowed, but PI was allowed to reformulate the verbal instructions or demonstrate the required action making it more understandable (for example through the use of objects). The PDMS-2 final raw scores were converted to standard scores for subsets and the quotients for gross motor (GMQ), fine motor (FMQ), total motor (TMQ) and then these scores were classified performance wise into 7 categories: very superior, superior, above average, average, below average, poor and very poor. This was followed by assessment with Wee-FIM scale and the extent of functional impairment that these motor dysfunctions are causing in the daily living of the child was measuredin the domains of Self - help, mobility and cognition. [4] The scores were given between 1-7 based on the flow-charts provided and later these scores were compared to the age norms as per the chronological age of the child.

Statistical analysis:The collected data were numerically coded and entered in Microsoft Excel 2010, and then analyzed using SPSS-

Version 23.0., (SPSS Inc, Chicago, USA). Proportions, means, medians, standard deviations and confidence intervals were calculated as appropriate for demographic characteristics, main parental concerns and test results. Using SPSS-23 software, 1-sample Binomial test was used to analyse scores in each subset in the total sample. Correlation between each subset in PDMS -2 and WeeFIM in the total sample was done by using t -Test, Levene's equity of mean, C hi -square test.

Results:

This study had 60 children with ASD of which 38 among them were males (58.3%). 48.7% reported that the main parental concern was decreased response to name call and decreased eye contact and 40% reported speech delay. The mean age of children was found to be 45.97 months +/ -7.97 SD in the present study population. The mean maternal age was found to be 26.1 years +/ -2.796SD.

In the present study, 41 out of the total 60 (68.3%) ASD children were found to have motor impairments as seen by the Total Motor Quotient which was in the range of below average, poor and very poor in PDMS -2.Among the gross motor domain, the commonest subset affected was object manipulation (34/60; 58.3%) followed by locomotion (48.3%) and stationary (46%) whereas, in fine motor domain the most affected subset was visual -motor integration (35/60; 58.3%) followed by grasping (35%). When comparing the motor quotients of PDMS -2 it was found that Gross motor functions were affected in 71.7%, Fine motor in 65.1% and Total motor functions were affected in 68.3% of children with ASD. (Table:1)

Table:1 Performance of ASD children in PDMS-2 in Subsets& Motor Quotients

Std score	**Above average**		**Average**		**Below Average**		**Poor**	
Parameter	n	%	n	%	n	%	n	%
Locomotion	1	1.7	30	50	29	48.3	-	-
Stationary	1	1.7	32	53.3	26	43.3	1	1.7
Object Manipulation	1	1.7	24	40	32	55	2	3.3
Grasping	1	1.7	38	63.3	18	30	3	5
Visual- motor integration	1	1.7	24	40	30	50	5	8.3

Quotients parameter	**Above average**		**Average**		**Below average**		**Poor**		**Very poor**	
	n	%	n	%	n	%	n	%	n	%
GMQ	1	1.7	16	26.7	36	60	7	11.7	-	
FMQ	1	1.7	20	33	31	51.7	7	11.7	1	1.7
TMQ	1	1.7	18	3036	29	48.3	10	16.7	2	3.3

When ASD was compared with motor scores subsets, all had significant issues with stationary, object manipulation and visuo-motor integration (Table:2). When PDMS2 quotients were analysed, present study finds all 3 quotients were significantly affected($p<0.05$).

Table:2PDMS subset scores and quotientsin ASD

Subset Variable	Yes	no	Total(N)	Test Statistic	P-value	Quotients	Total(N)	Test Statistic	P-value
Stationary	46	14	60	46	0.007	**GMQ**	60	17	0.001
Locomotion	40	20	60	40	0.124	**FMQ**	60	21	0.028
Object Manipulation	51	9	60	51	0.001	**TMQ**	60	19	0.007
Grasping	35	25	60	35	0.441				
Visual-motor integration	51	9	60	51	0.001				

When the functional significance of all the identified motor issues were analysed using Wee-fim it showed thatall ASD children were affected in a statistically significant way (P value<0.05) in self-care (eating, grooming, bathing, bowel & bladder management and total self-care); and cognition, but not in mobility.

Table:3 Wee-Fim functional scores in ASD.

SELF CARE

Variable	Yes	No	Test Statistic	P-value
Eating	57	3	57	<0.001
Grooming	48	12	48	<0.001
Bathing	39	21	39	0.028
Dressing(upper)	33	27	33	0.519
Dressing(Lower)	27	33	33	0.519
Toileting	35	25	25	0.245
Bowel management	21	39	39	0.028
Bladder management	16	44	44	<0.001
Self-care total	58	2	58	<0.001

COGNITION

Variable	Yes	No	Test Statistic	P-value
Comprehension	60	0	-	-
Expressive	59	1	59	<0.001
Social interaction	43	17	17	0.001
Problem solving	56	4	56	<0.001
Memory	52	8	52	<0.001
Cognition total	60	0	-	-

MOBILITY

Variable	Yes	No	Test Statistic	P-value
Transfers - chair	1	59	59	<0.001
Transfers –toilet	31	29	29	0.897
Locomotion-walking	11	49	49	<0.001
Locomotion -stairs	9	51	51	<0.001

Among the scores in Wee-fim,Mobility was not significantly NOT affected in any of the children. Everyone was significantly affected in other two areas with p value of </= 0.001.

Table:-4- GMQ vs WEEFIM

WeeFim- Variables	GMQ	N	Mean	SD	F	df	p-Value
Eating score	No	17	4.82	0.636	5.012	58	<0.001
	Yes	43	3.63	0.874			
Grooming score	No	17	3.88	0.781	0.878	58	<0.001
	Yes	43	2.74	0.79			
Bathing score	No	17	3.94	0.659	2.442	58	<0.001
	Yes	43	2.79	0.833			
Dressing (Upper) score	No	17	4.53	0.717	1.73	58	<0.001
	Yes	43	3.53	0.909			
Dressing (Lower) score	No	17	4.35	0.606	3.618	58	0.001
	Yes	43	3.56	0.881			
Toileting score	No	17	4.88	0.781	2.276	58	<0.001
	Yes	43	3.79	0.989			
Bladder management score	No	17	5.35	0.493	3.832	58	0.016
	Yes	43	4.7	1.036			
Bowel management score	No	17	6.12	0.485	7.663	58	0.02
	Yes	43	5.47	1.077			
Self-care total score	No	17	37.88	3.967	3.124	58	<0.001
	Yes	43	30.16	6.264			
Transfers-Wheel chair score	No	17	7	0	1.642	58	0.534
	Yes	43	6.98	0.152			
Transfers-Toilet score	No	17	6	0.612	9.895	58	0.057
	Yes	43	5.56	0.854			
Transfers-Shower score	No	17	5.71	0.47	4.128	58	0.046
	Yes	43	5.42	0.499			
Locomotion-Walk score	No	17	6.41	0.507	4.819	58	0.002
	Yes	43	5.95	0.486			
Locomotion-Stairs score	No	17	6.06	0.429	20.552	58	0.001
	Yes	43	5.51	0.551			
Mobility total score	No	17	31.18	1.551	1.072	58	0.001
	Yes	43	29.42	1.88			
Comprehension score	No	17	3.82	0.636	2.763	58	0.143
	Yes	43	3.51	0.768			
Expression score	No	17	3.41	0.939	2.599	58	0.632
	Yes	43	3.23	1.411			
Social interaction score	No	17	3.47	0.8	0.318	58	<0.001
	Yes	43	2.53	0.855			

Problem solving score	No	17	4.41	1.004	0.032	58	0.007
	Yes	43	3.63	0.976			
Memory score	No	17	4.35	0.786	0.094	58	0.064
	Yes	43	3.91	0.84			
Communication total score	No	17	19.47	2.764	2.901	58	0.016

To understand how the issues in GMQ affected the functional ability of child, GMQ was compared with variables of Wee Fim, it was found nearly all the variables in functional ability were affected except expression, comprehension and memory.

Table:5:- FMQ vs WEEFIM scores

Variable	FMQ	N	Mean	SD	F	df	p-Value
Eating score	No	21	4.76	0.7	2.404	58	<0.001
	Yes	39	3.54	0.822			
Grooming score	No	21	3.86	0.854	0.004	58	<0.001
	Yes	39	2.64	0.668			
Bathing score	No	21	4	0.707	1.235	58	<0.001
Dressing (Upper) score	No	21	4.52	0.75	0.734	58	<0.001
	Yes	39	3.44	0.852			
Dressing (Lower) score	No	21	4.38	0.669	1.361	58	<0.001
	Yes	39	3.46	0.822			
Toileting score	No	21	4.95	0.74	4.308	58	<0.001
	Yes	39	3.64	0.903			
Bladder management score	No	21	5.48	0.512	3.75	58	<0.001
	Yes	39	4.56	0.995			
Bowel management score	No	21	6.24	0.539	4.544	58	<0.001
	Yes	39	5.33	1.034			
Self-care total score	No	21	38.19	4.106	1.631	58	<0.001
	Yes	39	29.21	5.587			
Transfers-Wheel chair score	No	21	7	0	2.254	58	0.468
	Yes	39	6.97	0.16			
Transfers-Toilet score	No	21	6.19	0.68	0.683	58	<0.001
	Yes	39	5.41	0.751			
Transfers-Shower score	No	21	5.76	0.436	4.27	58	0.002
	Yes	39	5.36	0.486			
Locomotion-Walk score	No	21	6.43	0.507	7.656	58	<0.001
	Yes	39	5.9	0.447			

Locomotion-Stairs score	No	21	6.05	0.384	28.983	58	<0.001
	Yes	39	5.46	0.555			
Mobility total score	No	21	31.43	1.502	0.033	58	<0.001
	Yes	39	29.1	1.667			
Comprehension score	No	21	3.95	0.669	1.94	58	0.006
	Yes	39	3.41	0.715			
Expression score	No	21	4.76	1.071	0.259	58	0.14
	Yes	39	3.54	1.373			
Social interaction score	No	21	3.86	0.75	0	58	<0.001
	Yes	39	2.64	0.785			
Problem solving score	No	21	4	0.978	0.123	58	<0.001
	Yes	39	2.64	0.854			
Memory score	No	21	4.52	0.746	0.03	58	0.007
	Yes	39	3.44	0.823			
Communication total score	No	21	4.38	2.971	0.645	58	<0.001

When FMQ was analysed with WeeFim , the present study finds only transfer wheel chair and expression were not affected significantly.

Table:-6 TMQ vs WEEFIM total score

Variable	TMQ	N	Mean	SD	F	df	p-Value
Eating score	No	19	4.74	0.733	2.043	58	<0.001
	Yes	41	3.61	0.862			
Grooming score	No	19	3.79	0.855	0.016	58	<0.001
	Yes	41	2.73	0.775			
Bathing score	No	19	3.95	0.705	1.373	58	<0.001
	Yes	41	2.73	0.775			
Dressing (Upper) score	No	19	4.47	0.772	0.832	58	<0.001
	Yes	41	3.51	0.898			
Dressing (Lower) score	No	19	4.32	0.671	2.167	58	0.001
	Yes	41	3.54	0.869			
Toileting score	No	19	4.95	0.78	2.961	58	<0.001
	Yes	41	3.71	0.929			
Bladder management score	No	19	5.42	0.507	3.642	58	0.002
Bowel management score	No	19	6.21	0.535	4.906	58	0.002
	Yes	41	5.39	1.046			

Self-care total score	No	19	37.84	4.167	2.33	58	<0.001
	Yes	41	29.8	6.071			
Transfers-Wheel chair score	No	19	7	0	1.932	58	0.501
	Yes	41	6.98	0.156			
Transfers-Toilet score	No	19	6.11	0.658	3.637	58	0.005
	Yes	41	5.49	0.81			
Transfers-Shower score	No	19	5.74	0.452	4.507	58	0.012
	Yes	41	5.39	0.494			
Locomotion-Walk score	No	19	6.42	0.507	5.991	58	<0.001
	Yes	41	5.93	0.469			
Locomotion-Stairs score	No	19	6.05	0.405	25.302	58	<0.001
	Yes	41	5.49	0.553			
Mobility total score	No	19	31.32	1.529	0.408	58	<0.001
	Yes	41	29.27	1.789			
Comprehension score	No	19	3.89	0.658	2.402	58	0.035
	Yes	41	3.46	0.745			
Expression score	No	19	3.53	0.964	1.324	58	0.325
	Yes	41	3.17	1.412			
Social interaction score	No	19	3.47	0.772	0.24	58	<0.001
	Yes	41	2.49	0.84			
Problem solving score	No	19	4.47	0.964	0.033	58	0.001
	Yes	41	3.56	0.95			
Memory score	No	19	4.37	0.761	0.019	58	0.035
	Yes	41	3.88	0.842			
Communication total score	No	19	19.74	2.746	2.268	58	0.002

Table:7 :- TMQ vs WEEFIM scores

Comparison of TMQ with Wee Fim score variables also give almost all parameters except expression was significantly affected.

Variable	**TMQ**	**N**	**Mean**	**SD**	**F**	**df**	**p-Value**
WEEFIM score	no	19	88.89	7.355	2.169	58	<0.001
	yes	41	75.68	10.859			

Total Wee-Fim score analysed with TMQ also gives a significant P value(<0.001).

Discussion:

This study was done to gain an understanding of the various possible motor abnormalities, if any, that manifest and functionally interferes in children with ASD. The two assessment tools that were selected- PDMs-2 and Wee-Fim(3-8 years) are designed to pick up even the minute aspects of age appropriate development of the motor domain and its functional implications.

There are direct standardized assessments of motor function which provides quantification of motor ability in children, and it makes it simpler to compare and contrast to typically developing children. However, there remains a significant gap in our ability to evaluate motor function in NDD children particularly with ASD, due to the heterogeneity encountered, and these gaps are Ingrid in the individual and global limitations of these assessments.[5] PDMS-2 was selected to evaluate the finer aspects of motor development which may miss the eyes of even the astute clinician, especially in NDD's like ASD. Further refinement in assessing this important aspect of development is possible only by identification of these gaps.

In the present study the male preponderance (n=35;58.3%) was slightly more than that of female (n=25; 41.7%). This is in congruence with the INCLEN study and census 2011 which states that prevalence among boys was 12.4% (95CI10.2-15%) and 10.2% in girls. The mean age of NDD children was 45.97 months+/-7.97SD in the present study.[6]

58.3% of all ASD's(n=35) had comorbidities; among the comorbidities Seizures were more common comorbidity in ASDs (n=13; 21. 7%). The most frequent primary parental concern was decreased response to name call and decreased eye contact (46.7%) closely followed by speech delay (40%). This shows that among the non-motor problems, main concerns parents identify earlier and are distressed about are mainly centered on speech and social interaction. Only 8.3% of parents of children with ASD reported sensory issues as a pressing issue affecting their kids.

This also raises a valid question- whether the parents need to be made aware of the additional sensory issues that most of these children have, which may be identified by the treating personnel as symptoms/signs of an ASD, increasing their stress levels or should the sensory issues be curtailed to the treating personnel (therapist/doctor) at their discretion. A larger study on the identifying the need of creating awareness for parents on sensory issues and benefits of the same may give better idea about this issue.

To assess the presence of motor impairments, PDMS-2 was administered. PDMS-2 assessed the children in 2 motor domains- Gross and Fine motor. In the gross motor domains the commonest affected was object manipulation (n=34; 58.3%) followed by locomotion (n=29; 48.3%) and stationary (n=26; 46%).(Table:1) Even though we selected children with ASD, this analysis brings out the gross motor dysfunctions that were missed out in clinical examination. Though the clinical examinations couldn't pick the subtle changes, it was found to be interfering in the test parameters in a significant way making children underperform. In fine-motor sets, visual motor integration (n=35; 58.3%) was most affected followed by grasping (n=21; 35%). (Table:1).

A One sample chi-square analysis showed the following-in stationary, locomotion object manipulation, grasping domains most were either above the hypothesised number for "above or below average"; however, in object manipulation and visuo-motor integration, the observed values

were significantly more than the hypothesised values in "below average" category when compared with average category.

Fulceri fracessca et al in their study had slight difference from the present study. They found that locomotion and grasping were the most affected in pre-school children with ASD whereas in ours object manipulation and visuo-motor integration were more affected. [7]This may be due to exclusion of all ASD children with any overt motor impairments, genetic causes or syndromes such as Rett syndrome, Lennox-Gestau syndrome, Tuberous sclerosis etc in the present study. The purpose of our study was not to find if motor impairments are present or not in ASD, but was to find out the subtle motor dysfunctions which are missed during routine general examination and may affect the functionality of the child in day- to- day life. In this study both Gross Motor (Object manipulation and locomotion) and Fine Motor (mainly visuomotor integration) skills are impaired, suggesting the possibility of motor difficulties due to some specific mechanism involving motor control (i.e., motor planning). We found that skills such as object manipulation and VMI are more impaired than Stationary and grasping skills(Table:2), this is in agreement with previous reports [8,9,10]. Object manipulation represents the most noticeable gross-motor vulnerability area in pre-schoolers with ASD and it is in concordance with a lack of coordination or a defect of motor planning [11] . A kinematic analysis of gait (ELITE system) indicates that, rather than gait parameters or balance control, the main components affected in autistic children during locomotion are the goal of the action, the orientation towards this goal and the definition of the trajectory due probably to an impairment of movement planning.

Analysis of motor quotients in PDMS-2 in ASD showed 100% of ASD had gross motor dysfunction. Gross motor domain was most affected with 71.7%, followed by fine motor quotient 65.1% and total motor quotient 68.3%. In FMQ, Fine motor dysfunctions were seen in 63% of children with ASD with 51.7% being in below average, 11.7% in poor and 1.7% falling in very poor category. When total motor quotients also had similar results and were significant also. (Table:1, 2)

To check the presence of functional disability in ASD children and to assess the affected domains in day to day living, we administered Wee-Fim test. Analysis of data showed that all children had issues in "Self-care" domain especially in eating (95%), grooming (80%), bathing (65%), toileting (58.3%), dressing upper body (55%), dressing lower body(45%)(Table:03). The difference in percentages in upper body and lower body dressing could be due to the higher amount of fine motor skills and concentration involved in putting dress for upper body.

In the mobility domain, none had any problems in transfer from wheel chair and transfer from shower. 51.6% had issues in transfers- toilet. In cognition, comprehension all had issues(Table:3). All ASD had dysfunctions in toileting pointing to a probable combination of skill deficit due to motor component along with sensory issues in this disorder.

A study using developmental delayed children of same age group as the present study found that significant correlation between Functional Independence Measure for Children scores(Wee-Fim) with both verbal comprehension age and verbal expression age. [12] This points to the possibility of interference of language in assessing using Wee-Fim tool, which we acknowledge might have caused interference.

One sample binomial test done for each subsets of

Wee-Fim. It was found that statistical significance was there for eating, grooming and bathing and total self-care(Table:4). In mobility p-value was not statistically affected. In Cognition all 5 subsets were significantly affected.

Binomial analysis done for all subsets in PDMS in ASD children; None of them came to be significant. When Binomial analysis was done in motor quotients, all 3(GMQ, FMQ, TMQ) were found to be significant (Table: 2) This maybe because certain items in each subset would have been given more weightage. Hence, when you take them individually it may not appear to be affected but however, when you take them in-toto, it becomes significantly affected scores.

When two-tailed test and Levene analysis was done on GMQ vs Wee-Fim parameters to assess how much the dysfunction on gross motor affects functional ability in ASD children, all subsets of self-care was affected (P value<0.001). Eating, followed by bathing and toileting were more affected among them. (>Fvalue). (Table:4) In mobility GMQ was significantly affecting the following subsets- locomotion- stairs, locomotion-walk, transfer-toilet was significantly affected (p-value<0.05). In Cognition, GMQ was influencing problem solving and social interaction more. This could be due to motor dysfunctions making it difficult to face the community.

When FMQ was assessed for significance with functional abilities, it was found that all self-care skills were significantly affected (p-value<0.001). Levene's analysis shows more F-value for bowel management, toileting, bladder management and eating in that decreasing order showing these were more affected by fine motor issues. For locomotion domain also, climbing stairs, toilet-transfer and walk was affected significantly in decreasing order (P value-<0.001). Climbing stairs was very significantly affected among the three according to Levene's analysis. In the cognition domain, Social interaction and problem solving were more affected, which is expected of ASD children. (Table-05). TMQ vs Wee-Fim score analysis were statistically correlating (<0.001). (Table:06). There are studies which used similar diagnostic tools bringing out the possibility of using them together. [11]

When functional abilities in ASD was assessed using Binomial test for Wee-Fim, we found eating, grooming and bathing to be significantly affected (p<0.001). In mobility subset, only transfer- toilet was affected(P <0.05).(Table:03)

When ASD diagnosis was correlated with motor quotients, object manipulation and visuo-motor integration were significant (P-value=0.001) (Table2). The motor impairment characterized by a relative preservation of static abilities along with a major impairment in VMI and object manipulation skills appear to be relative stable at preschool age as correlation analysis between chronological age and PDMS-2 measures did not reveal any significant results. This is in agreement with some studies. [12]Present study supported the existence of a stable pattern of motor impairment in pre-schoolers with ASD. However, further longitudinal studies are needed to establish motor dysfunctioning and its effect over time.

The motor impairments which were present in the so called non-motor ASD [13] were not significant enough to cause statistically significant functional impairments in day to day living, which was found by Levene's test and 2-tailed test.

Hence, we reject the hypothesis that these motor issues are statistically significant to cause functional impairment in ASD. Even though, motor dysfunctions are significantly present in NDD/ASD on its own[14] they are not significantly affecting the functional ability of the child, but may be along with other issues such as visual,

hearing, sensory, familial, environmental, genetic factors etc. may be the contributing factors for functional difficulties that the NDD children are facing.

Conclusion:

Gross motor functions were found to be slightly more affected than fine motor in preschool children with ASD. Among the gross motor domain the commonest subset affected was object manipulation followed by locomotion and stationary. In the functional day to day activities the most affected skill was eating followed by grooming and bathing. All the children with ASD had motor impairments on PDMS-2. Among all the ASD children the functionality in day-day living as assessed by Wee-FIM showed self -care and cognition domains as the most affected. Even though, gross motor functions were the most affected still it did not affect functional mobility of the child.

ASD appears as a typical prototype for NDD and has almost the same dysfunctions when assessed separately. Hence in N DD's where motor dysfunctions are not overtly present, if any functional impairment is present, we need to assess them for both fine motor and gross motor dysfunctions interfering with functional abilities and take necessary corrective measures including assessing for other parameters which may be confounding the functional assessments.

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