

Analyzing original and new norms of Dasii on gross motor development among infants: A comparative study

KALYANI SHARMA*¹, SWETA SHARMA² AND DIVYA SHARMA³

^{1&2}M.Sc. Scholar and ³Assistant Professor

Department of Human Development and Family Studies, College of Family and Community Sciences
Maharaja Sayajirao University of Baroda, Vadodara (Gujarat) India

ABSTRACT

Developmental Assessment Scale for Indian Infants (DASII) was studied in the regions of Baroda (Gujarat) and Kangra (Himachal Pradesh). Age-range wise differences with focus on gross motor development were examined under the study. Sample size involved 400 full terms healthy babies of 6 to 12 months from Baroda (Gujarat) and Kangra (Himachal Pradesh) selected through purposive and snowball sampling techniques. The motor performance of the infants was recorded through DASII standardized kit and manual with standard procedure. Statistical analyses involved mean standard deviation and t-test. Results were suggestive that environmental factors, awareness of parents and educational status of the parents have key determining effect in the growth rate of children. The growth of girls was found faster than boys. Also, regional difference was observed as infants in Kangra, Himachal Pradesh showed faster growth in each age range than the infants in Baroda, Gujarat.

Key Words : Motor development, Gross motor development, DASII, Growth, Age-range, Regional differences

INTRODUCTION

Motor Development is one of the best indicators of overall well-being in the first year of life. As such, an understanding of its developmental course is of utmost importance to clinicians and infant specialists. Unfortunately, the database for this period in the lifespan is especially limited in reference to developing countries. The more widely used infant assessment tools were established with data collected and standardized on Western European and North American samples and applied in other regions. However, the body of research provides a rather convincing case that differences in motor development are likely due to a variety of cultural effects (Brill, 1986; Cintas, 1988; Solomons, 1982; Super, 1976; Werner, 1972), namely, factors associated with child-rearing practices and family characteristics.

Motor development refers to changes in children's ability to control their body's movements, from infants'

first spontaneous waving and kicking movements to the adaptive control of reaching, locomotion and complex sport skills (Adolph *et al.*, 2003, 134).

“Motor behavior includes every kind of movement from involuntary twitches to goal-directed actions, in every part of the body from head to toe, in every physical and social context from solitary play to group interactions. The development of motor behavior bridges the entire life span from the first fetal movement to the last dying breath “(Adolph and Franchak; 2016). The knowledge of motor and mental performance of infants is very important for their wellbeing. In western countries a lot research has been done on motor growth and development during early years of life. Motor development is most amazing during the first year of life. In this period of time, infants acquire ability to sit, stand, development of bones and muscles; walk and manipulation of his/her environment. The links between motor skills and other psychological functions is not apparent. It means that

motor and mental development is related to each other.

In past studies from different regions of the world it has been reported that a lot of research has been done on motor growth and development during early years of life. Motor development is most amazing during the first year of life. In this period of time, infants acquire ability to sit, stand, development of bones and muscles; walk and manipulation of his/her environment.

When an infant has learned to sit properly (gross motor) then she can easily use her hands to pick a toy or anything from the floor (fine motor), this show that gross motor development and fine motor development go hand in hand. It means that motor and mental development is related to each other. Many studies have been done worldwide, that shows motor development of infants has increased nowadays because now parents are well educated and are very much aware about health and nutrition of their children.

Cross cultural studies:

Motor development, environment and child rearing practices:

The accomplishment of gross motor skills in infants is global but the age of gaining these skills depends on biology, environment and parenting. In a study it is well documented that developmental course of motor development during first year of life is the combination of biological forces, environmental effect and active parenting (Lester and Brazelton, 2006). There are some standard milestones made by different psychologists and developmentalists to know the range of accomplishment of these skills. Pediatric health care providers use these milestones to know about the developmental delays in children or to help the late achievers. In a study it is well documented that developmental course of motor development during first year of life is the combination of biological forces, environmental effect and active parenting (Lester and Brazelton, 2006). The growth and development rate of child is now increased as compare to previous studies. Psychological test have come in trend now for testing the developmental mile stones of the children. So researches on motor development suggest that, despite of repeating admonitions, local norms should be established. A study on cultural issues in child assessment by Nikapota (2009) has stated that one of the principle way in which development and behavior is influenced by culture is through differences in parenting and child rearing practices. This study shows that child

rearing practices and surrounding environment accelerates child's development.

A study on cultural issues in child assessment by Nikapota (2009) has stated that one of the principle way in which development and behavior is influenced by culture is through differences in parenting and child rearing practices. This study shows that child rearing practices and surrounding environment accelerates child's development. According to Cintas (1989), behaviors which characterize by culture are the product of social and environmental influences. The social and environmental influence begins at very early years of life. They said that nature and nurture issues are very important in development. First preference should be given to maternal care practices which may promote accelerated motor development.

According to many cross cultural studies in developing countries it is found that in developing countries gross motor development is accelerated than in western countries and this acceleration is due to child rearing practices because parents use multiple strategies to encourage the development of their infants. But there are very less researches done in this field.

Link between Mother's Encouragement and Discouragement for Motor Development Mothers plays important role in the infant's motor development. Mother provides the child hands on intervention which help them to explore while safety is maintained. If physical intervention is not possible mother can provide help through verbal information and gestures, emotional display and language. In emotional expression mother's would use angry expressions and panicked sounds to discourage infant's activity, and use calming and cheering voice tone to promote their movements (Karasik *et al.*, 2008). Mother guides infant through verbal information. Mothers showed different kind of spoken information that give infant, the knowledge of different locations and actions when encouraging the words like "good" and when discouraging, exert their attention to the situation such as look and depicts characteristics of the shield and the outcomes of attempting descent, for example: look its steep, walk carefully. Mothers also provided a wide phalanx of gestures that offered visually prime knowledge to infants. All mothers used gestures such as claps to encourage the action and "stop" to refer to locations and the steep (Karasik *et al.*, 2008).

Researches in India indicate that massage; stretching and daily bath is the daily routine of the infant. Infant's

limbs are given long smooth strokes up, special oil rubbing in their skin and their body is vibrated during massage. All these augmented practices helps in the strengthening the infant's muscles which helps in motor development. In India, the sitting onset of age, ranges from 3.8 to 9.2 months and average age for sitting is 5.9 months. This is reported by World Health Organization (WHO) that these striking variability's are due to different child rearing and augmentation practices. According to a research by Chitra Sankar (2012), kangaroo care also plays important role to providing care to the infant. It is beneficial for both child as well as mother. There is skin to skin contact between mother's breast and infant during kangaroo care.

METHODOLOGY

Research design:

This study is a comparative research design. The study aims to make comparisons between original and new norms of gross motor skills of DASII (Developmental Assessment Scale for Indian Infants).

Participants:

A total of 400 from six month to twelve month old infants from Baroda (Gujarat) and Kangra (Himachal Pradesh) were recruited to participate in this study for the time span of twelve months. All were healthy full term babies. The proportions of male and female infants were comparable, 52% males and 48% females (223 males and 198 females). Infants were recruited from the villages of district Kangra and Baroda city with the help of paediatricians, doctors, health workers, anganwadi supervisors and anganwadi workers. Except mild illnesses all the children were healthy born babies and unhealthy or mentally disabled babies were excluded. The mean ages of infants were 9.36 months and 1.82 Standard Deviation overall. The mean age of males was 9.4 (SD=1.90) and mean age of females was 9.2 (SD=1.74). The mother's mean age was 26.68 (SD=2.454) and father's mean age was 29.69 (SD=2.735).

Procedure:

DASII scales were administered with the standard procedure mentioned in the manual. The administration of each item was initiated by testing the appropriate start item corresponding to the chronological age of the infant. The subsequent items were presented until the child had failed three consecutive items and in most cases all the 13 items are tested because children performed items

sometimes after more than three consecutive failures. The items related to previous age levels are considered as passed items and added to the sum scores.

Tool description:

DASII manual has two scales: Motor scale and mental scale

Motor Scale of infant development:

Motor scale of infant development consists of 67 items. This study has focused only on gross motor skills of infant development that is item no. 42-54 which are related to walking, sitting and standing.

Material Required from DASII Kit:

Pellet, cubes/ spoon, toy, ball, large wheeled toy, stair case. Administration of tool: Tool was administered as per the standard procedure given in the manual. Same procedure was followed and it took 15-20 minutes to assess a child but sometimes it took 30-35 minutes that happens in the cases when the child was not in happy mood or when child got irritated or sometimes when child is sleepy. Validation of the study was done with the help of experts

Data analysis:

Preparation and Problems in Applying the Scales Assessment of DASII requires set up with furniture of standard dimension and the material kit with the manual. Room should be spacious so that tester, infant and caretaker can move around easily. The room should be carpeted and sound proof so that it should not disturbed by outside noises and people. It is very important to retain infant's attention towards the tester. Assessment requires critical observation of the child's responses.

Problems in infant testing:

For making assessment successful it is very important for the tester to develop following points:

- Tester has to maintain patience with the child.
- Make child happy and relaxed under testing.
- Testing should be made like a play activity for the infant though might be a timed assignment for tester.
- Tester has to understand child's interest and then plan the testing accordingly. Following are some situations created by the infant during testing:
 - Children showed their interest in some materials even after the completion of observation. Sometimes they

wanted to take some material to home.

– Sometimes infants refused to play under testing conditions.

Problem with interference of mothers:

– During the testing conditions, when child fails to respond, mothers would start helping child. Sometime mothers develop negative attitude towards testing or tester. So to avoid this, tester has to explain the things to the mother by taking her in confidence.

– Help during testing inhibits child's independent responses to the test material, which may inhibit his scores.

– If testing is fixed by prior appointment, the mother should be explained that it is important to bring the child in a normal happy and relaxed mood.

Testing an infant and recording his performance:

Testing was started according to age appropriate items but when child was observed to do later items efficiently then he was credited for lower items according to the nature of item. For example, when a child is observed to sit with good coordination he is credited for all items of sitting at lower level. The items in the motor scales from 42-54 *i.e.*, sitting, standing and walking were administered and observed as per rules given in the DASII manual. The child was credited for all the prior items s/he passed. The child was given three trials and the best performance was scored. Before closing the testing it was checked that all the items were correctly credited. While checking the credited record of the child, leave the mother and the child playing alone. Wherever any credit needed to be observed again the relevant item was administered again. The free-play of the mother and the child at this stage was utilized in checking the items scored on the basis of child's spontaneous actions and interactions with the surroundings. For certain observations help of the accompanying adult in stimulating the response to be observed was proposed.

RESULTS AND DISCUSSION

Fifty two percent (n=203) of the infants were boys and forty eight percent (n=198) of the infants were girls (Table 1).

Background information of the participants:

The Table 2 shows the demographic profile of the participants. It includes the information on ethnicity,

Table 1 : Distribution of children by age and gender

Age Ranges	No. of Boys (203)	No. of Girls (198)
5.9-6.6	17	14
6.8-7.6	25	30
7.7-8.6	19	26
9.0-9.5	34	32
9.7-10.2	23	47
10.8-11.4	39	27
11.7-12.5	36	22

mother- father education, and monthly income. Majority of the parents were educated till higher secondary.

Table 2 : Demographic profile of participants

Characteristics	Number / Percentage
Ethnicity	401
Hindu	370/92%
Muslim	31/8%
Monthly income	
<5000	79/19.7%
5001-15000	191/47.6%
15001-25000	99/24.6%
25001-50000	22/5.4%
>50000	22/5.4%
Mother's education	
Illiterate	8/1.9%
Primary and Elementary	52/12.9%
HSC and SSC	206/51.3%
Graduate (including MBBS, BAMS)	79/19.7%
Post- Graduate and above (including MD, MS, Ph.D.)	56/13.9%
Father's education	
Illiterate	10/2.4%
Primary and Elementary	34/8.4%
HSC and SSC	71/17.7%
Graduate (including MBBS, BAMS)	189/47.1%
Post- Graduate and above (including MD, MS, Ph.D.)	97/24.1%

These are the items used for assessment of the babies in the study. These items mainly include gross motor skills and are related to sitting, standing, climbing and walking with and without help. These items assess babies on gross motor skills.

Age range wise differences between original and new data on gross motor skills:

The Table 4 shows the comparison between mean and standard deviation of original and new data according to age ranges. There are significant differences between

Table 3 : Items used for testing infants in the study

Item No.	Item Description	Age-Placements			97% Rank	Content Cluster
		50%	3%	97%		
42.	Walks with help	8.5	6.9	10.9	42	V
43.	Pat-a-cake – Mid-line Skill	8.7	6.4	10.1	43	V
44.	Sits down	9.3	7.0	12.2	44	II
45.	Stands alone for a few moments	10.1	7.1	12.2	45	II
46.	Stands-up from supine position through rolling on stomach and on fours	11.1	7.1	12.2	46	II
47.	Throws a ball - directed	11.6	9.8	15.2	48	V
48.	Walks alone a few steps	12.0	7.9	14.4	47	III
49.	Walks sideways	13.3	11.0	15.2	49	III
50.	Walks backwards	13.5	11.2	16.1	50	III
51.	Stands on right foot with help	13.9	11.2	17.3	51	IV
52.	Stands on left foot with help	13.9	11.2	17.4	52	IV
53.	Climbs up steps with help	14.8	13.1	21.4	54	III
54.	Walks down steps with help	16.6	13.2	21.3	53	III

*50% represents age when average infants can perform an item, 3% represents the minimum age when children can perform an item and 97% represent the maximum age when children can perform an item.

original and new mean scores. Now children are faster and growing at a very rapid rate due to the environmental factors, awareness of the parents and sometimes educational status of parents also help them to take good care of their children. This study includes 400 full term and healthy infants. The proportion of boys and girls were 48% girls and 52% boys. Majority of parents have received secondary education and only small proportions have received less than secondary education. These are the ranges given in DASII manual itself. There are significant differences in each age range and children have started performing the items prior than the ages mentioned in DASII manual. Earlier children in age range 5.9-6.6 were only able to perform 32 items but in new sample researcher found that they are able to perform till 39 items, in age range 6.8-7.6 were able to perform 37 items but now children are able to perform 41 items,

in age range 7.7-8.6 were able to perform 40 items but now they are able to perform 44 items, in age range 9.0-9.5 were able to perform 44 items but now they are able to perform 46 items, in age range 9.7-10.2 were able to perform 45 items and now they are able to perform 48 items, in age range 10.8-11.4 were able to perform 46 items and now they are able to perform 50 items and in age range 11.7-12.5 earlier children were able to perform 47 items and now the children are performing 52 items. These show significant changes in mean and standard deviations between original and new data.

The results also show that girls are performing faster in each domain except walking. Children are performing each item prior than the age mentioned in DASII manual and each value show significant differences in comparison after applying t-test. Table 2 shows the age range wise

Table 4 : Age ranges wise difference between Vadodara and Himachal Pradesh

Age-Range	Mid-Age	N		Mean With SDs				t-value	
		Baroda	HP	Mean		SDs		Value	Significance
				Baroda	HP	Baroda	HP		
5.9-6.6	6.1	5	14	39.20	37.88	1.58	1.86	1.409	0.177
6.8-7.6	7.0	11	30	43.27	40.98	1.38	0.77	6.711	0.000**
7.7-8.6	8.3	12	32	45.08	43.82	0.877	0.693	4.991	0.000**
9.0-9.5	9.1	18	27	47.00	45.95	1.40	1.78	2.104	0.041
9.7-10.2	10.0	23	45	48.56	47.94	1.41	1.52	1.630	0.108
10.8-11.4	11.1	29	23	49.37	49.92	1.54	2.14	-1.077	0.287
11.7-12.5	12.5	15	43	51.33	51.52	1.40	1.98	-0.342	0.734

**t-value significance 0.01 level

comparison of means and standard deviation and also the t-values between original data and new data. Table 4 shows the comparison of means with standard deviations. Children have showed faster development at early ages prior than the age mentioned in DASII manual.

Mean scores and standard deviation of the motor age according to age ranges given in the DASII manual were calculated. The t-test was applied to compare the mean original norms and new calculated means and standard deviation. Results of t test analyses comparing original and new norms revealed significant differences favoring 8, 11 and 12 months. Mean scores of girls and boys were calculated to see the difference. In the table 5 the comparison between the Baroda sample and previous DASII norms are illustrated. These age ranges were given in the manual of DASII.

In Table 5 the differences between Baroda and Himachal Pradesh in some item ranges are not significant. In two ranges the scores are significant and these ranges include items related to walking and standing. The infant from Himachal Pradesh have early age placements in comparison to Baroda. According to the observation of research team these differences are due to more exposure of Himachali infants to the environment. Due to more exposure to environment these infants are more involved in physical activities.

Children have shown early advancements in each domain and the hypothesis that is the children will perform faster than the original norms was proved significant. Overall mean scores of the study has shown significant differences. This study described the gross motor development of infants of Baroda and Himachal Pradesh from 6-12 months of age. It was hypothesized that the age placements of present study would be earlier than in original norms. The results were analyzed and critically looked into and this hypothesis was proved significant.

Overall quantitative analysis indicated that the mean scores of infants on gross motor skills of present study showed advancement in developmental milestones in comparison to the norms given in the DASII manual. It was noted that all the items from 42 to 54 were placed earlier by one month. Children in original DASII manual were performing item number 45, 46, 48, 49 and 50 prior that standing with help but in our sample we found that children are performing the items related to standing and walking with help prior than walking and standing alone, that is, they were able to perform item numbers 51, 52, 53 and 54 prior than 46, 48, 49 and 50.

The earlier placements of the items were studied in reference to cross cultural studies. It was noted that there were advancement in age placements of the developmental milestones cross culturally. In a study by Bornstein *et al.* (2015), it was proved that infants have started sitting as early as at 5 months. The education and style of living were also associated with infant's gross motor development. Girls attained higher score in all item except walking. This finding was consistent with cross cultural studies. A study by WHO multicenter growth reference study group; 2006 children follow the pattern sitting, standing with assistance, walking with assistance, standing alone and walking alone.

Findings of the study also plotted positive association between mother's education and development of the infant. Mother's behavior encourages or discourages infant's motor behavior, because mothers tone of voice help the child where he should explore and where not. Infants of the lower socio economic group, show more advancement then higher socio economic group. In lower socio economic group infants were not provided with walker and provided with space to explore; in comparison they were faster in walking aspect than higher economic group. In higher economic group it was the thinking of

Table 5 : Combined Results of Baroda and Himachal in Comparison to Original DASII Norms

Age-Range	Mid-Age	N		Mean With SDs				Rounded Mean		t-values
		Old	New	Mean		SDs		Old	New	
				Old	New	Old	New			
5.9-6.6	6.1	17	19	32.76	38.39	2.86	1.58	33	39	5.967**
6.8-7.6	7.0	19	56	36.95	41.77	1.31	1.38	37	42	13.798**
7.7-8.6	8.3	21	56	39.90	44.24	2.04	.877	40	44	13.671**
9.0-9.5	9.1	18	58	43.50	46.30	1.61	1.40	44	46	7.152**
9.7-10.2	10.0	8	106	45.38	47.98	3.14	1.41	45	48	4.358**
10.8-11.4	11.1	9	79	46.44	49.73	1.25	1.54	46	50	6.116**
11.7-12.5	12.5	15	95	47.27	51.46	1.35	1.40	47	52	10.515**

**t-value significance 0.01 level

the parents that if they place their children on the floor they might harm themselves and cause damage. All of these limit gross motor development. Across cultural study looking at parenting styles and age of child in the US, Italy, Kenya, the Yucatan and Fiji found that child learning and parental investment of time with the child varied according to expectations related to the child's survival and role (Levine, 1988).

Children who were exposed to walker would take a little more time to walk as compared to children who were not exposed to walker, because in walker they do not have to practice balancing. And in several studies it is mentioned that early exposure to walking and exercise is necessary for the advancement of gross motor milestones.

Findings of the study depicting that the infants from Himachal Pradesh are advanced in some gross motor skills as compare to Baroda. The items are mainly walking related. In Himachal children get more stimulation and exercise and are exposed to environment in the early months of life.

In the present study differences in age placements in comparison to the tool are very much clear, this shows that every tool requires revision after some years. There are lots of factors in the environment that may sometimes lead to development or sometimes there may be some decrease in age placements. Continuous research should be made compulsory, so that these changes can be seen clearly.

REFERENCES

- Adolph, K.E. and Berger, S.E. (2006). Motor development. *Handbook of Child Psychology*.
- Adolph, K.E. and Robinson, S.R. (2013). The road to walking: What learning to walk tells us about development. *Oxford Handbook of Developmental Psychology*, **1** : 403-443.
- Angulo-Barroso, R. M., Schapiro, L., Liang, W., Rodrigues, O., Shafir, T., Kaciroti, N. and Lozoff, B. (2011). Motor development in 9 month old infants in relation to cultural differences and iron status. *Developmental Psychobiology*, **53**(2) : 196-210.
- Berger, S.E., Theuring, C. and Adolph, K.E. (2007). How and when infants learn to climb stairs. *Infant Behavior & Development*, **30**(1) : 36-49.
- Bornstein, M. H. (2014). *Handbook of cultural developmental science*. Psychology Press.
- Chaudhari, S. (1996). Developmental assessment tests: Scope and limitations. *Indian Pediatrics*, **33**(7) : 541-545.
- Cintas, H.M. (1989). Cross-cultural variation in infant motor development. *Physical & Occupational Therapy in Pediatrics*, **8**(4) : 1-20.
- Derevensky, J.L. (1981). Infant intervention and parent education: The necessity for an interdisciplinary approach. *J. Education*, 275-281.
- Hallems, A., De Clercq, D., Otten, B. and Aerts, P. (2005). 3D joint dynamics of walking in toddlers: A cross-sectional study spanning the first rapid development phase of walking. *Gait & Posture*, **22**(2) : 107-118.
- Karasik, L.B., Tamis-LeMonda, C.S., Adolph, K.E. and Dimitropoulou, K. A. (2008). How mothers encourage and discourage infants' motor actions. *Infancy*, **13**(4) : 366-392.
- Karasik, L. B., Tamis-LeMonda, C.S., Adolph, K.E. and Bornstein, M.H. (2015). Places and postures: A cross-cultural comparison of sitting in 5-month-olds. *J. Cross-Cultural Psychology*, **46**(8) : 1023-1038.
- Lohaus, A., Lamm, B., Keller, H., Teubert, M., Fassbender, I., Glüer, M. and Suhrke, J. (2014). Gross and fine motor differences between Cameroonian and German children aged 3 to 40 months: Results of a cross-cultural longitudinal study. *J. Cross-Cultural Psychology*, **45**(8) : 1328-1341.
- Phatak, P. and Misra, N. (1996). Developmental Assessment Scales for Indian Infants 1-30 Months: Revision of Baroda Norms with Indigenous material. Psychological University of Calicut, **41** :55-60.
- Phatak, P., Dhapre, M., Pandit, A.N. and Kulkarni, S. (1991). A study of Baroda development screening test for infants. *Indian Pediatr*, **28** : 843.
- Santos, D.C., Gabbard, C. and Goncalves, V. M. (2001). Motor development during the first year: a comparative study. *The Journal of Genetic Psychology*, **162**(2) : 143-153.
- Solomons, H. C. (1980). Standardization of the Bayley motor scale of infant development in Yucatan, Mexico. *Developmental Medicine & Child Neurology*, **22**(5) : 580-587.
- Sharma, K. (2017). Comparison of Original and Revised Norms of Gross Motor Skills on DASII (Developmental Assessment Scale For Indian Infants) in Baroda (Gujarat).
- Sharma, S. (2017). Comparison of Original and Revised Norms Of Gross Motor Skills on DASII (Developmental Assessment Scale For Indian Infants) in Kangra (Himachal Pradesh).

Williams, J. R. and Scott, R. B. (1953). Growth and development of Negro infants: IV. Motor development and its relationship to child rearing practices in two groups of Negro infants. *Child development*, 103-121.

Wu, Y. T., Tsou, K. I., Hsu, C. H., Fang, L.J., Yao, G. and Jeng, S.F. (2008). Brief report: Taiwanese infants' mental and motor development—6–24 months. *Journal of Pediatric Psychology*, **33**(1): 102-108.
