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Research Article

Child Handling Cultural Practices for Neuromotor Development in Infants in a Cohort of African Population: A Prospective Analytical Study

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Abstract

Background and aims: Despite the use of many cultural-handling practices to facilitate neuromotor development in African children, there is no documentation on their purpose and effectiveness. This study explored the child-handling cultural practices and their purposes in achieving neuromotor development for infants in an African population.

Methods: Sixty-four typically developing neonates (35 males) were involved in this prospective study from birth through 3 months of age. They were recruited from neonatal units of a tertiary and a secondary health institution in Lagos, Nigeria. Socio-demographic data of parents and anthropometric data of children (birth weight, head circumference, birth length and mothers' gestational age) were recorded. Alberta Infant Motor Scale (AIMS) was used to assess their motor development while child-handling exercises and their purposes were explored through an explorative interview after observing the processes.

Results: The infant's birth weight, head circumference and birth length were 3.2±0.5kg; 34.6±1.3cm; 48.1±2.2cm respectively with gestational age of 38.7±1.6 weeks and maternal age of 31.8±4.9years. Ten different Child Handling Exercises (CHEs) were identified with the most commonly practiced being supported sitting (87.5%) and the least being supported walking (31.3%). The CHEs were commenced from birth. Their median AIMS scores at one-month were 8 which progressed to 10 and 12 for two and three months of age respectively. Their median percentile rank at one-month was 75th percentile, while it was 50th percentile at 2-month and 3-month. At 3-months, their prone, supine, sit, stand and total neuromotor score was 4.25, 3.58, 2.30, 2.20 and 12.30 respectively which were higher than the documented norms. There was a significant correlation (p>0.05) between several child handling exercises and their neuromotor development.

Conclusion: Facilitatory exercises are common practices in Nigeria to expedite neuromotor development in infants. With child-handling practices, Nigerian children attained neuromotor milestones faster than the documented norms from the western world.

Keywords: African child; Child handling; Cultural practices; Infants; Neuromotor development

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Introduction

Neuromotor behaviour, neuromotor development and in fact all domains of child development are influenced by culture [1]. A resultant outcome of the pioneer work of Gesell in 1928 was the practise of generalizing normative values for neuromotor development to universal populations [2]. This generated the possibility of misconceptions about neuromotor development until recent evidence from findings of cross-cultural researches brought to the fore the fact that cultural differences in child-raising and handling practices accounts for accelerated or otherwise of ages of achievement of specific motor milestones in children [2-5].

Cross-cultural research is a scientific method of comparative research which focuses on systematic comparisons between cultures and explicitly aims to answer questions about the incidence, distributions and causes of global cultural variation [6]. There has been prevailing emphasis on motor milestones which has resulted in the domination of normative comparisons of onset ages on cross-cultural research. Furthermore, cultural differences in daily child-handling practices have been relied on albeit with anecdotal evidence, to explain accelerated and delayed onset ages in comparison to norms established from western populations [1,2,7]; while cross-cultural comparisons on neuromotor development has focused on comparisons between American and Western European infants against African and Indian infants [2,3]. Theses cross-cultural research has brought to light the influence of culture on neuromotor development by highlighting the effect of culture on the timing and sequence of motor milestones; features of developmental trajectories as well as on specialized movement patterns [1,2,8,9].

Mothers and caregivers in African populations have been known to carry out various soft tissue mobilization; passive stretching exercises; as well as facilitate active postural reactions of infants as part of daily bathing routines during child rearing [10,11]. This is

achieved by stretching infants' limbs, tossing them into the air, and propping them into supported sitting, standing and walking positions [11]. It has been found that infants who receive these exercises often begin sitting and walking at earlier ages than infants who do not [1]. In terms of age of onset of attainment of motor milestones, motor skills of certain African infants like in Uganda were remarkably advanced relative to the documented norms. Ugandan infants attained excellent head control earlier, sat independently at 4 months, stood upright at 7 months, walked well at 10 months and ran at 14 months; whereas American infants' heads lagged and limbs were flexed at comparative ages and in contrast sit at 6 months, stand at 11 months, walk at 11.7 to 12.5 months and run at 18 months [2]. In a comparison between mothers in the western countries and Cameroon, it was concluded that the variation between the infants in the two populations may be accounted for by the fact that mothers in the western world give more attention to their children by holding them while mothers in Cameroon leave their infants to sit alone on high stools for extensive periods; an action which is presumed to encourage early onset of sitting skills [1]. Furthermore, among the Kipsigis of Kenya, babies develop neck control, sit independently, and walk considerably earlier than North American infants [1]. As a matter of fact, Kipsigi parents deliberately teach these motor skills whereby in the first few months of life, babies are seated in holes dug in the ground, and rolled blankets are used to keep them upright [1]. Kenyan infants also displayed qualitative differences in muscle tone in comparison to those from the western populations [1,2,12]. In contrast, Zambian infants have been known to lag behind the western norms [13]; while Ugandan and European newborns showed no significant group differences [14].

In earlier studies from Nigeria [15,16], it was concluded that Nigerian infants demonstrate motor precocity in gross and fine motor domains of development in comparison to data among the Caucasians. Although these studies were carried out among Nigerian infants, their major weakness is in the fact that they focused mainly on age of onset of motor milestones rather than the sequence and trajectory of neuromotor development. Hence, there still exists a gap in the knowledge on neuromotor development among Nigerian children as it concerns sequential evolution of motor milestones through well-defined patterns of movement.

Differences in neuromotor development between African and western infants have been given possible link to their genetic variabilities as well as differences in child-handling practices [2]. However, evidence supports the view that cultural differences play a key role in the findings of accelerated development. This was demonstrated by the fact that only the skills that were encouraged by the cultural context showed acceleration [17]; the precocity was dependent on the duration of the special physical and social stimulation and the African advantage was lost when children were raised in more modern, western cultures [18].

Apart from the fact that most studies from Africa have failed to account for the trajectory of development, they are even very old which do not account for modern day technological age and advancement in the environmental exposure of a developing African child. Hitherto, the data from the Caucasian populations have been used as norm reference for a typical African child who has led to mis-interpretation and mal-labelling of a typical African child. The genetic variability and environmental differences have also not been accounted for. This has made objective clinical reasoning and inferences full of several personal judgments rather than empirical clinical decision making. Hence, it is highly imperative for a research that will make available, data from African population accounting for the environmental and cultural differences resulting in their peculiarity in neuromotor development. Therefore, this study explored the child-handling cultural practices carried out among infants from an African population.

Methods

Prior to the commencement of this study, the ethical approval of the Lagos University Teaching Hospital Health Research and Ethics Committee (Ref: ADM/DCST/HREC/1383) and Lagos State Hospitals Service Commission (LSHSC), Lagos State, Nigeria (Ref: LSHSC/2222/VOL.IVA/163) were obtained. This prospective exploratory study involved 64 typically developing infants from a tertiary and a secondary health institution in Lagos, Nigeria. The hospitals were selected based on the criteria that they are of high birth rate with full complement of experts like Obstetrics and Gynaecologists, Neonatologists, Paediatric Neurologists, Paediatric Surgeons, Mid-wives and Physiotherapists. Expectant mothers in these selected hospitals were approached in their third trimester of pregnancy among those attending the antenatal clinics. Their informed consent for the involvement of their expected child was obtained from the parents. Their expected date of delivery was noted which informed their regular follow-up for the researchers to be available during the period of their deliveries.

The infants were recruited as neonates at birth from the post-delivery wards of one tertiary and one secondary health institution in Lagos, Nigeria. Socio-demographic characteristics including birth weight, head circumference, birth length, mothers' gestational age and home address were obtained from baby charts at the health institutions. Informed consent was obtained from the mothers of the participants after explaining the nature of the study. The participants were apparently healthy without any congenital malformation or disorders.

This study is a prospective mixed-method study. It incorporated quantitative and qualitative aspects. The quantitative aspect of the study incorporated the assessment of neuromotor development using the Alberta Infant Motor Scale, while the qualitative aspect of the study incorporated the assessment of child-handling exercises.

The Alberta Infant Motor Scale (AIMS) was employed to assess motor development of the participants. It assesses infants from birth to independent walking and consists of 58 motor criteria which are distributed into four sub-scales which describe the development of spontaneous movement and motor skills in prone, supine, sitting and standing postures. This assessment was carried out at birth, 1 month, 2 months and 3 months of age.

To assess the child-handling practices, exploratory interviews were conducted to establish the various child-handling exercises that were carried out by the mothers or care givers, date of commencement of child-handling exercises were collected at this stage. This assessment was carried out when the participants were 1 month of age.

The infants were assessed at birth with the AIMS to obtain a baseline data. Repeated measures of the AIMS were carried out in the homes of the participants when participants were 1 month, 2 months

and 3 months of age. The assessment with the AIMS was carried out by scoring each sub-scale (prone, supine, sitting and standing). The items in each sub-scale were scored as "observed" or "not observed". The items in the observed range created a motor window. The sub-scale scores were calculated by giving each infant one point for the observed items within the motor window in addition to being given one point for all of the less mature items outside the motor window. Sub-scale scores were summed up into total AIMS scores and the percentiles of each participant was deduced from the total AIMS scores based on the graph contained on the AIMS. The sub-scale scores, total scores and percentile scores were recorded on the front cover of the AIMS and subsequently collated for data analysis.

At 1 month of age, the assessment of child-handling practices was carried out and their purposes were explored through an exploratory interview after observing the processes. The exploratory interviews were conducted using a hand-held voice recorder. The processes were observed concurrently with the exploratory interviews in the following manner: The mothers were asked to describe all the child-handling exercises that were carried out on the infant during or after bathing time. Each mother described the exercises in detail as they were carried out by demonstrating with their infant, the descriptions were recorded in the voice recorders, each described exercise was directly observed by the researcher as the descriptions were given and themes were generated on the spot based on the anatomical and physiological terms of the exercises being described and spoken into the recorder for record purposes. The information obtained from the oral interviews were aggregated and subjected to thematic analysis and the child-handling exercises were subsequently grouped into the following 10 themes: Trunk stretching, stretching of upper limbs, stretching of lower limbs, throwing, Soft Tissue Mobilization (STM), suspending upside down, supported sitting, supported standing, supported walking. After the third month of assessment, the mothers were followed up monthly via phone calls to establish the date of termination of child-handling exercises. The mother of each infant was called every month to confirm if they were still carrying out the exercises, calls were discontinues as soon as a mother confirmed that the exercises were terminated. These monthly phone calls continued until all mothers had confirmed that they had terminated the exercises.

Analyses were carried out using the Statistical Package for the Social Sciences (SPSS), version 21. The gross score of the AIMS was described as mean, median, standard deviation, minimum, maximum, and percentiles for the total sample. The child-handling exercises themes were categorized and subjected to descriptive analysis. Preliminary data obtained at birth were also subjected to descriptive analysis, while inferential statistics of Chi square was used to find associations between variables.

Results

A total of 64 neonates 35 (54.7%) males and 29 (45.3%) females took part in this study. The mean birth weight, head circumference and birth length were 3.2±0.5kg; 34.6±1.3cm; 48.1±2.2cm respectively (Table 1). The estimated gestational age had a median value of 38 weeks and a mean of 38.7±1.6 weeks; while the maternal age had a median value 32 years years and a mean of 31.8±4.9 years. The mean birth weight for females was 3.6±0.4 (kg) and for males was 3.2±0.5 (kg); the mean head circumference for females was 34.8±1.2cm and males was 34.4±1.3cm; while the mean birth length for females was 48.0±2.0cm and for males was 48.1±2.4cm.

Variables	Range	Mean	Median	Mode
Birth				
Prone score	0 - 2	2.09	2.0	1
Supine score	0 - 3	1.98	2.0	1
Sit score	0 - 1	1.87	1.0	1
Stand score	1 - 2	1.02	1.0	1
Total score	2 - 8	3.96	4.0	4
Percentile rank	10 - 90	69.17	75.0	75
1st Month				
Prone score	1 - 7	2.85	3.0	2
Supine score	1 - 5	2.67	3.0	2
Sit score	1 - 2	1.02	1.0	1
Stand score	1 - 2	1.73	2.0	2
Total score	6 - 12	8.27	8.0	8
Percentile rank	25 - 90	63.21	75	90
2nd Month				
Prone score	1 - 7	3.23	3.0	3
Supine score	2 - 5	2.91	3.0	3
Sit score	1 - 2	1.18	1.0	1
Stand score	1 - 3	1.77	2.0	2
Total score	6 - 12	9.09	10.0	10
Percentile rank	10 - 90	49.61	50.0	75
3rd Month				
Prone score	2 - 9	4.61	4.0	3
Supine score	2 - 9	4.29	4.0	4
Sit score	1 - 8	2.90	2.0	1
Stand score	1 - 3	2.42	2.0	2
Total score	7 - 24	13.76	12.0	10
Percentile rank	10 - 90	49.67	50.0	75

Table 1: Descriptive Distribution of AIMS Scores of the Participants from Birth to 3 months.

The Alberta Infant Motor Scale (AIMS) results were presented as the sub-scale scores based on their four postural assessments in prone, supine, sit and stand. The measures of central tendencies for the results of these sub-scales as well as the total scores and percentile ranks of the participants are in table 1 below. At birth, the total scores ranged from 2 to 8, while percentile rank ranged from the 10th to 90th percentile; with a mean total score of 3.96 and percentile rank of 69.17; while the median total score was 4. Majority of the participants had a total score of 4 and percentile rank of 75th percentile at birth. The breakdown of sub-scale scores at birth are contained in table 2. By one month of age, the total scores had increased to range from 6-12 with a percentile range from 25th to 90th percentile. By this age, majority of the participants had a total score of 8 and ranked at the 90th percentile. The median total score and percentile rank at 1 month was 8 and 75th percentile respectively. At 2 months of age, there was an apparent reduction in rate of neuromotor development with the range of total AIMS score remaining at 6-12 range and median percentile rank dropping to the 50th percentile. At this age, the majority of the participants ranked at the 75th percentile rank. However, the median and mode values of total AIMS scores had increased to 10 at 2 months of age. By 3 months of age, there was a change in the range of total

scores to a range of 7-24, while the percentile range was once again 10th to 90th percentile. The mean prone AIMS score of the participants was 4.25, supine was 3.58, sit was 2.30 and stand 2.20 and total was 12.30. The mean percentile rank was 49.67, while the median rank was 50th percentile. More that 70% scored above the 50th percentile rank. However, majority of the participants had a 75th percentile ranking and a total score of 10 (Table 1).

Table 2 gives the developmental trajectory of neuromotor behaviour of the participants from birth to 3 months of age. This trajectory represents the average qualitative level of motor skills attained by the participants at the given ages; through postural assessment and based on the sub-scale assessment of the AIMS. The level of neuromotor development of the participants in prone position at birth was predominantly that of physiological flexion with momentary head raise of up to 45 degrees neck extension; at 1 and 2 months of age this has progressed to the ability to position the elbows behind the shoulders while raising the head; while at 3 months of age, the head raised has gone beyond 45 degrees in addition to chest elevation. In supine, the prevalent developmental skill at birth is Head rotation towards mid-line; mouth to hand, random arm and leg movements; while by the ages of 1 month, 2 months and 3 months majority of the participants had progressed to the ability to bring the hand in mid-line while tucking in the chin with active neck flexor muscles. The predominant neuromotor behaviour attained at in sitting includes the ability to lift and maintain head in mid-line at birth and then by the 1st, 2nd and 3rd month of the participants were able to support their weight on their arms briefly in sitting position. In standing, at birth, the participants neuromotor behaviour consisted of intermittent hip and knee flexion, by the age of 1 month, 2 months and 3 months, the participants had achieved the ability to hold the head in line with body with Hips behind the shoulders and variable movement of legs.

The child handling practices employed by caregivers were assessed and documented as Child Handling Exercises (CHEs). A total of 10 different CHEs were identified: Trunk stretching, stretching of upper limbs, stretching of lower limbs, throwing, Soft Tissue Mobilization (STM), suspending upside down, supported sitting, supported standing, supported walking. The most commonly practised child handling exercise was supported sitting (87.5%) while the least commonly practised child handling exercise was supported walking (31.3%). Three major purposes were identified for the exercises. The purposes included joint flexibility, bone strength and alignment as well as overcoming fear. It was observed that the stretching exercises were done for joint flexibility while soft tissue mobilization was carried out to facilitate bone alignment and strengthening. Majority of the exercises carried out, were carried out to help the infant overcome fear these included throwing, suspending upside down, supported sitting, supported standing and supported walking.

Tables 3-5 give the relationship between the AIMS scores for sub-scales as well as total and the total exercises carried out on the participants, from the first to third month of life. In the 1st month, there was a statistically significant negative correlation between stretching of upper limbs and stand score; as well as between moist heat soft tissue mobilization and sit score. In the second month, there was a significant positive correlation between trunk stretching and supine score; throwing exercises and prone score; and suspending upside down with sit score as well as with total AIMS score. There was a significant negative correlation between supported standing and sit score as well as between supported walking and supine score. In the third month however, there was a significant positive correlation between trunk stretching and supine score as well as between supported sitting and supine score but there was a significant negative correlation between stretching lower limbs and prone score.

The results of table 6 gives the relationship between the total number of child handling exercises carried out on the participants and their Neuromotor Development (NMD); as well as the relationship between the purposes for the exercises and the NMD vis-a-vis the sub-scale scores in the 1st, 2nd and 3rd months of life. There was a statistically significant correlation between the total number of exercises carried out and the supine scores in the second month of life. However there was no statistically significant correlation between the total number of exercises and the prone scores, sit score, stand score or total AIMS scores in the first 3 months of life as well as the supine scores in the 1st and 3rd months of life ($p<0.05$).

Age (Months)	Motor milestones in prone	Motor milestones in supine	Motor milestones in sitting	Motor milestones in standing
Birth	**In prone lying:** Physiological flexion. Turns head to clear nose from surface; Lifts head asymmetrically to 45 degrees. Cannot maintain head in midline	**In supine lying:** Head rotation towards midline; mouth to hand. Random arm and leg movements;	**Held in supported sitting:** Lifts and maintains head in midline.	**Held in supported standing:** May have intermittent hip and knee flexion;
1	**Propped on forearm in prone:** Elbows behind shoulders with unsustained head rise at 45 degrees.	**In Supine lying**: Neck flexors active: Chin tuck. Brings hands to midline.	**When pulled to sit:** Lifts and maintains head in midline. Supports weight on arms briefly.	**In supported standing:** Head in line with body Hips behind shoulders Variable movement of legs.
2	**Propped on forearm in prone:** Elbows behind shoulders with unsustained head raise at 45 degrees.	**In Supine lying:** Neck flexors active: Chin tuck. Brings hands to midline.	**When pulled to sit:** Lifts and maintains head in midline. Supports weight on arms briefly.	**In supported standing:** Head in line with body Hips behind shoulders Variable movement of legs.
3	**On forearm support:** Lifts and maintains head past 45 degrees Elbows in line with shoulders. Chest elevated.	**In supine lying:** Neck flexors active: Chin tuck. Brings hands to midline.	**Sitting with propped arms:** Maintains head in midline. Supports weight on arms briefly.	**In Supported standing:** Head in line with body Hips behind shoulders Variable movement of legs

Table 2: AIMS Neuromotor Developmental Trajectory of the Participants from Birth to 3 months.

Child handling exercises	Purpose of exercise	*f*	*%*	Prone score		Supine score		Sit score		Stand score		Total AIMS	
				r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*R*	*P*
Stretching trunk	Joint flexibility	33	51.6	0.07	0.67	-0.15	0.32	0.17	0.26	-0.03	0.87	-0.02	0.89
Stretching upper limbs	Joint flexibility	49	76.6	0.19	0.22	0.07	0.66	-0.09	0.56	-0.31*	0.04	0.09	0.55
Stretching lower limbs	Joint flexibility	48	75.0	-0.23	0.14	-0.11	0.50	-0.09	0.54	0.07	0.65	-0.25	0.11
Moist heat soft tissue massage	Bone strength and alignment	32	50.0	0.09	0.57	0.06	0.67	-0.35*	0.02	0.15	0.33	-0.24	0.12
Throwing	Overcoming fear	46	71.9	-0.04	0.80	-0.16	0.30	0.10	0.52	-0.10	0.51	-0.15	0.34
Suspending upside down	Overcoming fear	34	53.1	-0.17	0.28	0.01	0.96	-0.16	0.31	0.07	0.67	-0.14	0.38
Supported sitting	Overcoming fear	56	87.5	0.01	0.94	0.05	0.75	-0.04	0.87	-0.26	0.10	-0.26	0.09
Supported standing	Overcoming fear	29	45.3	-0.16	0.32	0.10	0.54	0.001	0.99	-0.13	0.40	0.001	0.99
Supported walking	Overcoming fear	20	31.3	-0.003	0.99	0.10	0.52	-0.008	0.96	0.04	0.78	0.04	0.78
Soft tissue massage	Bone strength and alignment	40	62.5	0.17	0.29	-0.13	0.40	-0.17	0.27	0.13	0.41	0.09	0.57

Table 3: Correlation between AIMS scores, Total exercises and their purpose in the first month.

*Significant at $p < 0.05$

Child handling exercises	Purpose of exercise	*f*	*%*	Prone score		Supine score		Sit score		Stand score		Total AIMS	
				r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*R*	*P*
Stretching trunk	Joint flexibility	33	51.6	-0.11	0.64	0.57*	0.01	0.04	0.85	-0.31	0.17	0.14	0.54
Stretching upper limbs	Joint flexibility	49	76.6	-0.07	0.77	-0.16	0.47	-0.15	0.51	-0.14	0.54	-0.14	0.56
Stretching lower limbs	Joint flexibility	48	75.0	-0.07	0.77	-0.16	0.47	-0.15	0.51	0.14	0.54	-0.14	0.55
Moist heat soft tissue massage	Bone strength and alignment	32	50.0	0.04	0.85	0.02	0.92	-0.22	0.33	0.19	0.39	0.13	0.57
Throwing	Overcoming fear	46	71.9	0.42*	0.05	-0.20	0.37	0.22	0.32	0.02	0.93	0.29	0.19
Suspending upside down	Overcoming fear	34	53.1	0.38	0.08	0.12	0.61	0.47*	0.03	0.08	0.70	0.53*	0.01
Supported sitting	Overcoming fear	56	87.5	0.08	0.71	-0.05	0.84	0.19	0.40	0.08	0.72	0.12	0.59
Supported standing	Overcoming fear	29	45.3	0.02	0.92	-0.34	0.13	-0.52*	0.01	-0.05	0.83	0.34	0.13
Supported walking	Overcoming fear	20	31.3	0.06	0.79	-0.45*	0.04	-0.29	0.19	-0.13	0.58	0.34	0.13
Soft tissue massage	Bone strength and alignment	40	62.5	-0.34	0.12	-0.70	0.76	-0.24	0.28	-0.27	0.22	-0.48*	0.03

Table 4: Correlation between AIMS scores, Total exercises and their purpose in the second month.

*Significant at $p < 0.05$.

Child handling exercises	Purpose of exercise	*f*	*%*	Prone score		Supine score		Sit score		Stand score		Total AIMS	
				r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*R*	*p*
Stretching trunk	Joint Flexibility	33	51.6	0.21	0.17	0.33*	0.03	0.18	0.24	-0.05	0.76	0.23	0.13
Stretching upper limbs	Joint Flexibility	49	76.6	-0.13	0.39	0.17	0.27	-0.14	0.36	-0.18	0.22	-0.09	0.57
Stretching lower limbs	Joint Flexibility	48	75.0	-0.29*	0.05	-0.03	0.82	-0.27	0.07	-0.18	0.22	-0.26	0.08
Moist heat soft tissue massage	Bone strength and alignment	32	50.0	0.16	0.28	0.03	0.83	0.21	0.15	0.02	0.88	0.18	0.24
Throwing	Overcoming Fear	46	71.9	0.09	0.56	0.12	0.44	0.18	0.23	0.13	0.38	0.15	0.30
Suspending upside down	Overcoming Fear	34	53.1	0.06	0.69	-0.004	0.98	-0.004	0.98	0.07	0.64	0.03	0.81
Supported sitting	Overcoming Fear	56	87.5	0.21	0.15	0.29*	0.05	0.21	0.16	-0.16	0.30	0.23	0.13
Supported standing	Overcoming Fear	29	45.3	-0.08	0.59	-0.16	0.28	0.06	0.69	-0.001	0.99	-0.05	0.72
Supported walking	Overcoming Fear	20	31.3	-0.02	0.92	-0.19	0.21	0.02	0.92	0.02	0.92	-0.04	0.80
Soft Tissue massage	Bone strength and alignment	40	62.5	0.25	0.10	0.15	0.31	0.29	0.05	0.04	0.82	0.26	0.08

Table 5: Correlation between AIMS Scores, Total Exercises and their Purpose in the Third Month.

*Significant at $p < 0.05$

AIMS Scores	Total child handling exercises		Purpose of child handling exercises	
	r	*p*	*r*	*P*
1st Month				
Prone score	-0.19	0.90	-0.13	0.41
Supine score	0.09	0.55	-0.04	0.78
Sit score	-0.08	0.63	-0.16	0.31
Stand score	0.29	0.85	0.14	0.36
Total AIMS score	0.04	0.80	-0.11	0.49
2nd Month				
Prone score	0.23	0.29	0.17	0.45
Supine score	-0.46	0.03*	-0.47*	0.03
Sit score	0.34	0.88	-0.02	0.91
Stand score	0.10	0.96	0.25	0.26
Total AIMS score	-0.07	0.76	-0.05	0.83
3rd Month				
Prone score	0.18	0.22	-0.38*	0.01
Supine score	-0.08	0.59	-0.39*	0.01
Sit score	0.26	0.08	-0.29*	0.05
Stand score	0.13	0.38	-0.12	0.42
Total AIMS score	0.18	0.23	-0.38*	0.01

Table 6: Relationship between Child Handling exercises, Purposes of Child Handling Exercises and NMD.

*Significant at $p < 0.05$

Discussion

This study explored the child-handling cultural practices and their purposes in achieving neuromotor development for infants in an African population. Facilitatory exercises are common practices in Nigeria to expedite neuromotor development in infants. It was concluded that with facilitatory exercise and child-handling practices, Nigerian children attained neuromotor milestones faster than the documented norms from the western world. These observations present remarkable clinical implications for the application of facilitatory exercises in neuromotor development in early infancy. It presents the possibility that children at risk of delayed neuromotor development can be facilitated through purposeful child handling exercises to improve the neurodevelopmental outcome.

The observation from the the median percentile ranking, the infants in this study were more advanced in neuromotor development at every month for the first 3-months of life. This is in agreement with the observations by [2]; that However, there was an apparent decrease in rate of neuromotor development in the 2nd and 3rd month as seen in the comparatively lower median percentile ranking from that of the 1st month. This could imply that the neuromotor development of the infants had plateaued in progression. However, this phenomenon would be better appreciated if further repeated measures of the NMD were documented. At this point, the only change observed was in the prone position, where participants were on average able to progress from the ability to maintain elbows behind shoulders with unsustained head raise at 45 degrees to the ability to lift and maintain head past 45 degrees with elbows in line with shoulder and chest elevated. The other domains remained averagely stable in second and third month. This corroborated the assumption that prone position is a key position for new born infant development in the first few months of life, particularly as it is the position that most facilitates neuromotor development by providing extensor control of the neck to encourage active neck control [19].

The variability of the neuromotor development in this study from established norms can be attributed to genetic as well as environmental influences [2]. One of such environmental influences being the child handling practice. As established in studies by [2-4]; as well as [5], that child handling exercises accounts for accelerated ages of achievement of specific motor milestones in children. These findings are also consistent with the premises of the dynamic systems control theory of neuromotor development, which emphasizes the influence of the environment on NMD [20]. Child handling exercises in this context is presented as a cultural practice which is reflective of the environmental influence.

Among the identified child handling exercises, those with highest frequency of practice included the stretching of the upper limbs, lower limbs as well as supported sitting and soft tissue mobilization popularly referred to as massage. This is similar to practices among west indies cultures as well as east African cultures like those practiced in Kenya [1,2]. There is a dearth of literature on the purpose of the child handling exercises carried out in different cultures. From the results of this study, it was observed that stretching exercises were typically carried out for the purpose of facilitating joint flexibility, while exercises involving postural displacements like throwing, supported sitting standing or walking as well as upside down suspension were carried out for the purposes of helping the infant overcome fear. Soft tissue mobilization on the other hand was carried out to facilitate well aligned bones as well as bone strengthening. Furthermore, From the results, although sitting with support possessed the highest frequency of exercises carried out, of which the purpose is overcoming fear, from the frequency of the other exercises, it can be implied that the other purposes of joint flexibility and bone strength and alignment, bear equal importance to the mothers. It is however difficult to establish if the exercises carried out achieved the purposes for which they were carried out. This will best be established through further repeated measurement of variables as well as carrying out measurements that are specific to evaluate the purpose for each exercise. However, the descriptive results of this study give an overall impression that child handling exercises facilitate faster neuromotor development among Nigerian infants, compared to established western norms. This is corroborated by the findings in Adolph, et al. [2].

There was a statistically significant negative correlation between the between the total number of exercises carried out and the supine scores in the second month of life. It is difficult to ascertain the reason for this trend; however, this may imply that child handling exercises have the greatest impact on motor skills acquired in supine position.

In the first month, there was a statistically significant negative correlation between stretching of upper limbs and stand score; as well as between moist heat soft tissue mobilization and sit score. It is difficult to establish the reason for this pattern of motor behavior; however, this may imply that not all child handling exercises necessarily facilitate neuromotor development and that some may actually inhibit certain aspects of neuromotor development. In the second month, there was a significant positive correlation between trunk stretching and supine score; throwing exercises and prone score; and suspending

upside down with sit score as well as with total AIMS score. There was a significant negative correlation between supported standing and sit score as well as between supported walking and supine score this may imply that supported standing and supported are not one of the exercises that directly enhance faster neuromotor development. The purpose for these exercises were to help the infant overcome fear, however, since these purposes are subjectively determined by the caregivers, it is difficult to establish if the exercises accomplished the purpose for which they were carried out and if these purposes are desirable in the total scheme of neuromotor development. In the third month, there was a significant positive correlation between trunk stretching and supine score as well as between supported sitting and supine score but there was a significant negative correlation between stretching lower limbs and prone score. Overall, this study was able to establish that trunk stretching, throwing and upside down suspension exercises have a significant impact in facilitating neuromotor development. However, there is a dearth of literature involving robust statistical analysis with which to compare these findings, however, these finding are in agreement with the general consensus that child handling exercises facilitates early neuromotor development [2].

Conclusion

Facilitatory exercises are common practices in Nigeria to expedite neuromotor development in infants. With child-handling practices, Nigerian children attained neuromotor milestones faster than the documented norms from the western world. Children at risk of delayed neuromotor development can be facilitated through purposeful child handling exercises to improve the neurodevelopmental outcome.

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