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Norms for Gross Motor Development in Egyptian Toddlers: Pilot Study

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Abstract : Background: Peabody developmental motor scale is one of the most commonly used scales for assessment of motor developmental domain in preschool children; the Peabody is a reliable and valid tool to assess gross motor skills. In this study, the applied Peabody Developmental Motor Scale Second Edition (PDMS-2) could provide a general gross motor developmental framework for Egyptian children. **Objectives**: to establish norms for the Egyptian' toddlers in gross motor developmental variables through cross-sectional study design using PDMS-2 and comparing the results with the normative sample given in the PDMS-2 manual to find a method of evaluation that might be suitable for Egyptian toddlers. **Methods**: Normal healthy 80 children assigned into two groups in sequence according to their chronological age: group A (39 child) aged from 25 to 30 months and group B (41 child) from 31 to 36 months, after screening by Portage Scale through five nursery schools in Cairo governorate, Egypt whom scored at least 80% . Evaluation using PDMS-2 was applied once monthly to each group for successive six months in gross motor area of development through cross-sectional study design. **Results**: The present study revealed statistical significant difference for measured subtest items of gross motor development in this specific age when compared with the normative data using Z-scores. **Conclusion**: the study reflects that the development of Egyptian toddlers differs from normative sample of PDMS-2 in gross motor development subtest items, so detection of these differences in gross motor development illustrates the importance to have norms for the Egyptian children development to be a national reference for all staff working in pediatric physical therapy.
Key Words: Egyptian toddlers; gross Motor development; portage scale; Peabody Developmental motor scale-2.

1- Introduction

The processes of growth and development are not separately; however, growth is the natural increase of size of the body as a whole and of its separate parts. It results from multiplication of cells and increase in size of cells so the growth is a quantitative process. But the development means maturation of organs and systems, acquisition of new skills and functions as well as ability to adaptation and assuming responsibilities so the development is a qualitative process [1].

Children develop two types of motor skills, gross motor skills and fine motor skills. Gross motor skills, also called large motor skills, include activities involving large muscles and major muscle groups. Some gross motor skills an infant develops in his first year include head control, sitting up and standing [2].

The field of study concerned with the description and explanation of changes in motor performance and motor control across the life span is typically called motor development. The study of motor development has

historically focused on the period from conception through to adolescence, the changes and stages through which the developing human progresses in attaining adult levels of motor performance [3].

Motor development knowledge is typically derived from research studies of one of two main types; cross-sectional studies, in which motor control and performance are compared between different people of different ages, and longitudinal studies, in which the motor control and performance of the same set of people are traced over a number of years as they mature and grow older, in this study we applied both cross sectional and longitudinal design running through one year [4].

Developmental skills are unique to each child. No two children will meet these milestones at exactly the same age. However, it is important to know what to look for during the development of child skills so that you can be on the lookout for serious developmental delays. Although normal child development is the concept on which the abnormal development is established, it does not follow that assessment should rely upon a strict nearest to normal developmental schedules [5].

In the early childhood years, children begin to learn a group of motor skills known as fundamental motor skills (FMS). FMS are composed of locomotor skills and object control skills. Locomotor skills involve moving the body through space and include skills such as running, galloping, skipping, hopping, sliding, and leaping. Object control skills consist of manipulating and projecting objects and include skills such as throwing, catching, bouncing, kicking, striking, and rolling. These skills form the basis for future movement and physical activity [6].

The Peabody Developmental Motor Scale-2 (PDMS-2) is the most commonly used pediatric motor outcome assessment tool. The PDMS-2 is a standardized norm referenced test, it was designed to assess motor development in children from birth to 72 months of age that measures fine motor and gross motor skills. The possible uses of the PDMS-2 include; "Determination of motor capacities relative to a normative peer sample, assessment of qualitative and quantitative abilities of individual gross and fine motor skills, evaluation of development over time and determination of efficacy of interventions in research Three types of reliability measures were reported in the PDMS-2 manual: test-retest, inter-rater and standard error of measurement for total raw scores [7,8].

Peabody developmental motor scale is considered one of the most commonly used tests to assess motor development in preschool children; the Peabody is regarded as providing useful and comprehensive information for early assessment. At the end of this study; the applied Peabody developmental motor scale-2nd edition can provide a general gross motor developmental framework for Egyptian toddlers.

Child's development is affected by multiple factors such as psychosocial and biological factors and genetic inheritance. Poverty and its attendant problems are major risk factors affecting the motor development. The first few years of life are particularly important because vital development occurs in all systems [9,10].

Therefore; it was very important to establish norms for the Egyptian toddlers in gross motor developmental skills to find a way of assessment that might be standardized for Egyptian children.

2- Subjects and Methods:

2.1. Subjects

The study was designed as a cross sectional study. Normal healthy 80 children assigned into two groups in sequence according to age group A: from 25 to 30 months and group B: from 31 to 36 months after screening by Portage Developmental Scale (Arabic version) in Cairo area [11]. Evaluation using Peabody Developmental Motor Scale Second Edition (PDSM-2) was applied in Stationary, Locomotion and Object Manipulation areas of development [7].

2.2. Methods

All procedures were explained to the parents or care persons for children in nurseries and baby classes and permission to fulfill was taken. The selection procedure from 150 children in the five nursery schools was conducted by Portage Scale (motor development checklist) screening then randomly select 80 from 100

children whose get at least 80% of scoring by portage through randomization list to be involved into two groups; group A (39 children, 18 boys and 21 girls aged from 25 to 30) and group B (41 children, 19 boys and 22 girls aged from 31 to 36 months). Although screening by portage taken a long period of time to collect the sample included in the study, the time required for evaluation of each child in each group was an average of 15 minutes using Peabody Developmental Motor Scale (2nd edition). The study was running longitudinally for successive six months for each group.

2.2.1. Selection procedure

Motor development checklist of portage scale that was asked to care person as the following Questions: For group A: 1- Can your child draw vertical straight line using pencil or color brush? 2- Can the child jump from 20 cm height with both feet together? 3- Can the child feed himself e.g. using spoon?

For group B: 1- Can the child jump by both feet from one place to another for at least 3 meters? 2-Can the child holds a paper by one hand and cut with the other? 3- Can the child jump forward for at least 1.5 meters by one foot? 4- Can the child descend and ascend stairs getting one foot on each step (but can use handrails)?

2.2.2. Evaluation procedure

Children participated in this study received evaluation of Stationary, Locomotion and Object Manipulation subtest items of PDMS-2 according to their chronological ages (from 25 to 36 months), it was applied once monthly for all children, for a period of six successive months in each group.

While taken into consideration the basal and the ceiling level of scoring according to the Illustrated Guide for Administering and Scoring of the PDMS-2 Items [7]. The measurable items in this pilot study were **19** items :**12 items for group A**; Locomotion items (53-L: walking down stairs, 54-L: walking backward, 55-L: jumping up, 56-L: walking line, 57-L: walking upstairs, 58-L: jumping down, 59-L: walking on tiptoes, 60-L: running speed), and Object Manipulation items(10-O: catching ball,11-O: throwing ball-overhand,12-O: throwing ball-underhand,13-O: kicking ball) and **7 items for group B**; Stationary items(S-20: standing on one foot), Locomotion items (61-L: jumping forward, 62-L: jumping down, 63-L: jumping hurdles,64-L: walking on tiptoes,65-L: walking upstairs) and Object Manipulation items(14-O: catching ball).

3- Results

This study includes 39 children in group A as shown in table (1). Statistical analysis of the mean values shows significant differences found in all measured subtest items in favor of Egyptian children except 13-O.

Group B represented in table (2) which include 41 children. Statistical analysis of the mean values shows significant differences found in all measured subtest items in favor of Egyptian children except 64-L.

Table (1): the mean values (by months) of Egyptian and European children in group A (25-30 months) subtest items: (N=39)

Variables	Mean($\overline{X}$)	S.D.(S)	μ·	Z	SIG.
53-L	25.15	0.95	25.50	- 2.28	0.05
54-L	26.10	0.93	25.50	4.05	0.001
55-L	26.18	0.87	25.50	4.86	0.001
56-L	26.41	0.67	27.50	- 10.18	0.001
57-L	25.77	0.66	27.50	- 16.41	0.001
58-L	28.08	0.73	29.50	- 12.18	0.001
59-L	30.15	0.92	29.50	4.43	0.001
60-L	29.03	0.70	29.50	- 4.25	0.001
10-O	28.87	1.09	25.50	19.31	0.001
11-O	29.87	1.02	27.50	14.56	0.001
12-O	28.05	1.01	29.50	- 8.95	0.001
13-O	29.28	0.85	29.50	- 1.61	×

× not significant

Table (2): the mean values (by months) of Egyptian and European children in group B (31-36 months) subtest items: (N=41)

Variables	Mean($\overline{X}$)	S.D.(S)	μ·	Z	SIG.
20-S	29.71	0.71	31.50	- 16.24	0.05
61-L	30.51	0.77	31.50	- 8.23	0.001
62-L	31.24	0.90	31.50	- 1.81	0.05
63-L	31.93	0.87	33.50	- 11.63	0.001
64-L	33.63	0.96	33.50	0.90	×
65-L	33.88	0.74	35.50	14.05-	0.001
14-O	33.95	0.85	33.50	3.38	0.001

× not significant

4- Discussion

Monitoring a child's development in the first years of life is of the utmost importance, since this is the stage of extra uterine life when nerve tissue grows the fastest and matures and is therefore the most vulnerable. Because of children's great plasticity, it is also the period during which they respond best to therapy and to the stimulation they receive from their environment. For all these reasons, it is fundamental that health professionals, families, and communities take advantage of this time to monitor the development of all children [12].

In standardizing the course of motor development, researches focused on the typical child (who is, of course, no child), rather than on within- individual variability and individual difference. The idea of age appropriate activities as an index of intrinsic biological functioning is the received legacy of early work on motor skill acquisition. Ages and stages so thoroughly pervade our conception of motor development that every pediatrician's office and developmental textbook sports a requisite table of developmental norms [13].

Motor assessment scales designed for children of the same culture are not always appropriate for those from diverse ethnic backgrounds. This study was undertaken to compare the scores of children from one ethnic group with the scores of the children on whom the test was norm. It was observed that there were significant differences in the scores of the children from our sample, compared with the normative data given in the manual of PDMS-2. It indicates that cultural differences significantly affect the scores of the children on the scale [14].

Comparing between both Egyptians and normative children' results of evaluation procedure in gross motor subtests (Stationary, Locomotion and Object Manipulation) and its variables revealed significant difference in favor of Egyptians children in all items except 13-O and 64-L in group A and B respectively.

The motor skills that were significant difference are walking down stairs, walking backward, jumping up, walking line, walking upstairs, jumping down, walking on tiptoes, running speed, catching ball, throwing ball-overhand and throwing ball-underhand for group A. And standing on one foot, jumping forward, jumping down, jumping hurdles, walking upstairs, catching ball for group B while there were significant difference for the variables 'kicking ball and walking on tiptoes' in favor of the normative sample of PDMS-2 .

This results supported by Shumway-Cook and Woollacott [4] who stated the motor learning theory which reported that in order to optimize motor schemas, practice must occur under varied condition, as a training under varied conditions might help the child to learn the principles of postural control rather than a single way to control the center of the mass.

Long, Toscano and Ratliffe [15,16] stated that the typical motor development follows a predictable sequence. There are variations in this sequence, and rate at which each child moves through the sequence varies. These variations may be attributed to the fact that there is individual difference between children, including physical characteristics, temperament and personality.

Mayston [17] reported that children who get more opportunities to do more activities, motor development is better in them. Opportunities to play to gain knowledge give a better chance of developing sensory motor activities. Nutritious food promotes good motor development. Sensory motor development is dependent upon

nutrition that the child gets to a great extent. Children get stronger and development is good if they get nutritious food. If a child is immunized at a proper time it leads to good sensory motor development.

It was believed that there are significant differences in the way the brains of child develop. Environmental and socioeconomic differences include the age when certain developmental motor skills occur, differences in the sequence of development and where certain activities take place in the brain. These differences affect motor skill abilities of children [18].

Cintas [19] considered the importance of parental expectations in theories of motor development and the significance of the attainment of motor skills in the evaluation of children, understanding the influence of culture and its associated factor that was combine to shape a child' motor development within specific cultural context is of great practical value to pediatric clinicians.

This study has future implications for therapists wanting to administer any subtest or the whole subtests of the PDMS-2 to any child, in that they should consider the cultural upbringing of the child which may influence the child's score. Also if research is conducted using PDMS-2 as an evaluative or outcome measure the authors should keep in mind the effect of cultural differences on the scores.

5- Conclusion

The results showed significant differences between the scores of toddlers who aged from 25 to 36 months from Cairo, Egypt, who are typically developing and the normative sample of the PDMS-2 in gross motor development subtest items. As a result of this, it is necessary to evaluate the cultural sensitivity difference of standardized tests that dealing with assessment of motor development for a particular region and different ethnic group.

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