Synopsis for Ph.D. in Science (Human Physiology)

on

EVALUATION OF COGNITIVE SKILLS AND MOTOR ABITITIES OF PRIMARY SCHOOL CHILDREN

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Introduction:

Cognitive skills and motor abilities are important markers of the growth and development of the children. Those abilities are related to the function of the brain. This activities of the brains development occurred from the early infancy to the adulthood. During this period different areas of the brain emerges from immature state to mature state. Total 90% of brain development becomes completed at the age of six.

 Cognitive skill development in children involves the progressive building of learning skills such as attention, memory, and thinking. This crucial skills enables children to process sensory information and eventually learn to evaluate analyze, remember and make comparison and understood cause and effect. Although some cognitive skills development is related to child genetic makeup and most of the cognitive skilled are learned. So, the cognitive skills can be improved with suitable environment.

When child learns to pay attention it enables him to concrete on one task or conversation for an extended period of time. Learning to focus attention is an important cognitive skill that child uses virtually all future learning. Memory is an important cognitive skill that equipped a child to retain what he has learned and experienced and therefore build a future base of knowledge. The ability to think includes being able to learn the task and find the solution. This skill helps the children to know whether he's accomplishing what he set out to do or whether he needs to ask for help.

Motor development refers to changes in children's ability to control their body's movement from infant first spontaneous waving and kicking movements to the adaptive control of reaching, locomotion and complex sports skills. The motor behaviour includes all movements of our body including movement of eye and the infant's developing control of head. Gross motor action includes the movement of large limbs or the whole body. Fine motor behaviour

includes the use of finger to grasp and manipulate object. Motor behaviour such as, reaching, touching and grasping are the forms of exploratory activity. Motor movements including movement of the eyes, arms, legs and hand provide most of the perceptual information infant receive. As the infant grows, their body fat and muscle mass are redistributed, i.e., increment of muscle strength, neural myelination leads to speed of nerve conduction. Overall mechanism increases motor activities of the children.

Physical growth, cognitive skills and motor abilities are most important for children life. The cognitive skills and motor abilities may vary in different populations due to different factors. The degree by which these factors influence the performances of cognitive and motor abilities should be identified. Although different investigations were made on different populations, no comprehensive study has been conducted on Bengali population. Every population should have their normative data on cognitive and motor parameters of the growing children. However, such normative data is very scanty in Bengali population. That lacuna inspired us to study on cognitive skills and motor abilities on primary school children of Bengali population.

Aims and Objectives:

The aim of the present study was aimed to evaluate the cognitive skill and motor ability of primary school children.

The followings are the objectives of present investigation:

1) To evaluate motor ability and cognitive skill of primary school children

2) To evaluate physical growth, nutritional status of the primary school children.

3) To assess age and gender related changes of the motor ability and cognitive skill among the primary school children.

4) To find out the possible association between physical growth and cognitive skill as well as motor ability of primary school children.

5) To find out the possible association of cognitive skill and motor ability of primary school children with nutritional as well as socioeconomic parameters.

6) To find the graded norms for cognitive skill and motor ability parameters of primary school children.

Methodology:

The present study was carried out by primary school going children only. The study was conducted in different district of West Bengal state, India. For the fulfilment of the present study 905 children was employed, out of which 445 were boys and 460 were girls. For the purpose of the present study different cognitive parameters and different motor skill parameters along with socioeconomic status and nutritional status, and physical growth were studied.

The following cognitive and motor abilities tests were performed:

Colour trail test (CTT): It was the study of attention and conceptual tracking.

Colour cancellation test (CCT): It was the study of selective attention.

Fas phonemic fluency test (FAS): It was the study of executive function.

Picture completion test (PCT): It was the study of Visuospatial function.

Rays auditory verbal learning test (RAVLT) : It was the study of verbal learning and memory.

Result and Discussion:

Motor parameters such as Reaction Time (RT) which was the study of reaction time of the children, and Purdue peg board test which was the study of hand eye coordination, were employed. The peg input test was performed on dominant hand (DH), non-dominant hand (NDH) and both hands.

The socioeconomic status of the parents was evaluated by modified Kuppuswami scale. Anthropometric measurements, viz., body weight and height, were taken from the

subjects following standard technique and appropriate landmarks. Nutritional status of the participants was evaluated by 24-h recall as well as by the anthropometric methods. BMI was calculated from Height and weight using the following formula: BMI=weight (Kg) / height (meter) [2]. The stunted growth of the children was evaluated by the cut-off values of height using WHO guidelines.

The results of variation of cognitive and motor performances on age and sex revealed that there was a significant variation in performances of cognitive skill and motor ability of boys and girls from 5yrs to 10 yrs of age. The scores of Colour trail test (CTT) and Colour cancellation test (CCT) were found to be decreased with the advancement of age indicating better attention and conceptual tracking as well as selective attention of the children, as those were time related parameters. On the other hand, the scores of Fas phonemic fluency test (FAS), picture completion test (PCT), and verbal learning test (RAVLT) were found to increase indicating increase in executive function , visuospatial function, and verbal learning and memory of the children with the enhancement of age of the age. The ruler drop test shows a decrement of with the age from 5 to 10 years representing an increase of reaction time of boys and girls. The hand eye coordination of the children was also enhanced with the advancement of age as the scores of the peg board score were increased. Age was significantly and positively correlated with cognitive skill and motor ability variables of the children.

On the other hand it was found that there was significant variation in the cognitive skill and motor abilities between boys and girls. It was noted that performance scores of tests of attention (CTT, CCT), phonemic fluency (FAS), and verbal learning and memory (REC, LOT) of girls were significantly ($p<0.001$) greater than that of the boys. On the contrary, visuospatial function (PCT) of the boys was significantly ($p<0.001$) greater than girls.

Linear regression analysis demonstrated that the age of the children was associated with the score of different cognitive and motor variables. Multiple regression analysis demonstrated that after adjustment the effect of height, weight BMI, socioeconomic status, age had strong significant impact on the scores of different cognitive and motor variables.

The variation of performances of cognitive skills and motor abilities of the children with the nutrients intake were studied. The result revealed that the quantity of nutrient intake such as, protein, carbohydrate, calorie, folic acid, choline, and omega 3 fatty acid was significantly correlated with the scores of cognitive skills and motor ability variables of the children.

The result of nutritional status of the children, as determined by the BMI, indicated that majority of the children belonged to normal (Boys 67.2% ,Girls 64.34%) and undernourished (Boys 25.16% , Girls 26.52%) category, and a very few children were belonged to overweight / obese category.

The results demonstrated that the scores of cognitive skill and motor ability of the children was significantly ($p < 0.001$) higher in well nourished children compared to that of under-nourished and over-nourished children, as par BMI classification. Results of correlation coefficient revealed that BMI had strong significant ($p < 0.001$) and positive correlation with all the score of cognitive and motor parameters except CTT, CCT, RT. It was found that BMI had negative and significant correlation with the score CTT, CCT, RT. As those were time parameters, negative correlation indicated better performances. Linear regression analysis demonstrated that BMI was strongly associated with the score of different cognitive parameters and motor parameters but multiple regression analysis indicated that after adjustment the effect of age height, weight, and SES, no significant impact of BMI on the scores of the cognitive skills and motor ability tests were found.

From the results it was observed that out of 445 boys 35.05% were stunted and out of 460 girls 37.17% were stunted. The comparison between scores of cognitive skills and motor

abilities of stunted and non-stunted (normal) children revealed that the performances of the scores of the cognitive skills and motor abilities of non-stunted children were significantly higher (p<0.001) compared to the score of stunted children. Correlation coefficient of height with the score of different cognitive skill and motor ability variables were computed and result revealed that height was significantly and positively correlated with the score of all the cognitive parameters except CTT, CCT, and RT. The height had significant (p<0.001) and negative correlation with the score of CTT, CCT, and RT. The linear regression analysis demonstrated that height had strong significant association (P<0.001) with the score of different variables of cognitive skills and motor abilities. Multiple regression analysis demonstrated that after controlling the effect of age, height, weight, BMI, and SES, the height had no appreciable impact on the scores of cognitive and motor performances.

The socioeconomic status of the children was greater significant influential factors for cognitive skills and motor abilities of the children. The results revealed that the score of cognitive skill and motor ability of the children belonging to the lower socioeconomic status was significantly lower (p<0.001) than the scores of the children who belonged to middle and upper socioeconomic status. It was also noted that the socioeconomic parameters were significantly and positively correlated with all the score of cognitive and motor variables except CTT, CCT and RT; the CTT, CCT, and RT was negatively correlated with socioeconomic status. It was also revealed that socio demographic factors such as parental years of education, parental occupation, parental income and size of the family was strongly correlated with the score of different cognitive skills and motor ability variables. The results also demonstrated that CTT, CCT, and RT were negatively and significantly correlated with different socioeconomic factors. The family size had significant and negative correlation with the scores of FAS, PCT, REC, LOT, and peg board test for DH, and NDH, Both hand. Linear regression analysis demonstrated socioeconomic status was associated with the score of

different cognitive and motor parameters. Multiple regression analysis after controlling the effect of age, BMI, height and weight, demonstrated that the SES had significant impact on the scores of cognitive and motor parameters.

The growth pattern of different cognitive and motor parameters was studied and it was noted that growth of the variables was linear with the advancement of age. The growth of those variables was comparable with that of physical growth of the children.

The percentile growth curves for different cognitive and motor ability parameters were drawn. Different percentile values, viz., 5th, 15th, 25th, 50th, 75th and 90th percentiles were computed and shown in the growth curves. The 15th percentile and 90th percentile values were taken as the lower and upper cut-off values for motor and cognitive parameters of the children.

The norms for cognitive skills and motor abilities were determined by employing curve grading method and those were divided into five grades such as A, B, C, D, and F, which were designated as 'Excellent', 'Very good', 'Good', 'Average' and 'Poor' respectively. For representing the norms, the whole age group (5-10 years) of the children was divided into three groups, instead of six age groups, such as 5-6 year,7-8 year and 9-10 year. The graded norms for each of the cognitive and motor parameters may be treated as reference value of boys and girls of primary school children in Bengali population.

Conclusion:

It was concluded that the cognitive and motor variables of the primary school children were found to vary as a function of age. There was also gender variation in cognitive and motor function parameters of the children. The said variables were noted to be changed with the nutritional status of the children. The cognitive and motor variables had significant difference between stunted and normal children. Different socioeconomic factors, such as, number of

family members; parental education and composite socioeconomic status were the influencing factors for cognitive and motor performances of the children.

Main Achievements:

The followings are the main Achievements of the study:

➢ A database of different cognitive skill and motor ability parameters of the Bengali children has been formed.

➢ The percentile growth of different cognitive skill and motor ability parameters of the Bengali children has been established. Such growth chart will be helpful for assessing cognitive and motor growth status of any boy or girl of the Bengali primary school age children. Thus it would be possible to identify abnormal cognitive and motor growth of the boys and girls. Developmental Indicators for the children which assesses motor, cognitive, and language skills, school assessments, are mainly useful for testing if a child is experiencing developmental delay or disabilities.

➢ In the present investigation normative data for cognitive skills and motor ability parameters of the Bengali population have been formed. The parameters of the norms for cognitive skill and motor ability that help to determine the measures of the developmental progress of children such as behavior, reflexes, and responses. Further grading of the norms of different parameters has been done. The scores were divided into five grades such as A, B, C, D, and F, which were designated as 'Excellent', 'Very good', 'Good', 'Average' and 'Poor' respectively. The grading was done separately for different age groups as well as for boys and girls.

Such graded norms will be helpful for categorizing each of children according to their cognitive performance. Selection of children for interschool academic competition will be

easier to achieve success. Graded norms, especially of motor skill parameters, will be a guide for selecting the students for different indoor and outdoor sports events.

On the other hand, according to the grading of cognitive and motor parameters, the children with poor or lower score may be identified and special emphasis may be given on them. Some suitable training may be arranged for betterment of their skills.