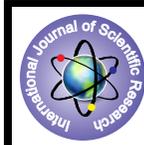


## Association of Nutritional Status on The Intelligence Level And Academic Achievement of Rural Primary School Children in West Bengal, India



### Education

**KEYWORDS :** Intelligence, Nutritional Status, Academic achievement.

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### ABSTRACT

*Objective: To investigate the association between nutritional status with the academic performances and intelligence level.*

*Design: A cross-sectional analytical study.*

*Setting: Government schools of Shimulpur, Salka & Kumarhut, Ramnagar Village, in the districts 24 Parganas North & South, West Bengal, India.*

*Subjects: 560 children aged 6 to 8 years (class II to IV).*

*Results: 26.77%, 15.35% & 29.82% of them were underweight, stunted & wasted, respectively while 1.16% was overweight according to BMI. 3.22%, 21.42%, 24.28% & 50.71% of them achieved B, C, D, E intelligence grades, respectively. 24.81% of the students achieved academic grade of A & B while 32.5% of them got E & F grades. Academic achievement of the children has significant positive correlation ( $P \leq 0.01$ ) with their intelligence level.*

*Conclusions: Overall nutritional and academic status as well as IQ level of the children under study is far from desirable.*

### INTRODUCTION

Malnutrition is a syndrome resulting from interaction between poor diets and diseases, leading to anthropometric deficits and generally with deficits in micronutrients. Anthropometry has become a practical tool for evaluating the nutritional status of populations, particularly of children in developing countries [1] and nutritional status is the best indicator of the global well-being of children [2]. One of the major global health problem faced by the developing countries, today is malnutrition [3,4].

Protein-energy malnutrition impairs the immune system, leaving malnourished children less able to combat common diseases, prolongs or exacerbates the course of an illness, heightens the adverse impacts of toxic substances, causes short stature and reduced physical work capacity, and increases the future risk of heart diseases. In addition to increasing the risk of death, severely-malnourished children are likely to have a lower intelligence level, behavior problems, and poor school achievement. Impaired mental development is perhaps the most serious long-term handicap associated with early childhood malnutrition [5].

According to the Global Hunger Index, South Asia has the highest child malnutrition rate of world's regions [6]. India contributes to about 5.6 million child deaths every year, more than half the world's total (FAO-2004).

Although the World Health Organization has estimated that the overall prevalence of stunting has fallen from 47% in 1980 to 33% in 2000 in developing countries, protein-energy malnutrition (PEM) which impairs the growth and development of children is still a major public health problem in poor communities [7].

Proper nutrition with adequate amounts of necessary micro-nutrients, protein, and calories, given at the appropriate time may ensure normal brain development. Major catastrophic congenital malformations like neural tube defects, hydrocephalus, mental retardation, and behavior problems may be prevented in some instances with proper nutritional supplementation and avoidance of certain lifestyle behaviors such as smoking and alcohol intake among women of child-bearing age. Therefore, ensuring an intelligent and smart child starts with a healthy moth-

er [8].

According to the estimates of National Family Health Survey, the prevalence of underweight children has declined from 53 percent to 46 percent; stunting has declined from 52 percent to 38 percent and wasting has increased from 18 percent to 19 percent during 1992-2005 in India [9].

In West Bengal 67.9% rural children under the age of five years are stunted or too short for age, 21% are wasted or too thin for their height, and 54% are underweight. Significantly 1.5% & 0.4% are overweight in terms of weight for height and weight for age [10].

Large numbers of children in the primary schools of West Bengal suffer severely from malnutrition due to inadequate consumption of macronutrients and micronutrients. About 69% of 6-17 years children attend schools & this percentage is 6% higher in urban areas than rural areas [10].

The possibility of a strong connection between nutrition and learning is of growing importance. Emerging data [11,12,13,14] indicate that malnutrition & micronutrient deficiency may affect the academic performance & mental development both in quantitative as well as qualitative ways in school children. In West Bengal, children suffer from various nutritional deficiencies which may contribute to their lower achievement in schools. Unfortunately, scanty data is available on the role of nutrition in primary school children's academic performance. Therefore, the present study is aimed to determine the relationship between the academic performance & intelligence level of primary school children with their nutritional status in West Bengal, India.

### MATERIAL & METHOD

The methodology adopted was a complementary approach using both qualitative and quantitative methods.

### PARAMETERS MEASURED

PARAMETERS	TOOLS/METHODS
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ACADEMIC RESULTS	Term end result of individual
HEIGHT, WEIGHT, BMI	Anthropometric rod, Weighing machine[15,16,17]
PSYCHOLOGICAL TEST (IQ) OF THE LEARNERS	Raven's Progressive Matrices Test (non-verbal intelligence test) [18]

**ASSESSMENT ACADEMIC ACHIEVEMENT OF THE LEARNERS**

Academic achievement of the students was evaluated using following grading based on the scores obtained by the participants in the class tests as per regulations of West Bengal Council of Primary Education:

- Grade A - 81 to 100%
- Grade B - 66 to 80%
- Grade C - 51 to 65 %
- Grade D - 36 to 50%
- Grade E - 21 to 35%
- Grade F - 0 to 20%

**Sampling**

Students were randomly selected considering some inclusion criteria.

**Inclusion criteria**

Following criteria were followed during selection of the children for the study: (i) children not suffering from chronic diseases & physical disabilities (ii) live with their mothers (iii) mothers are available for interviews (iv) participated in the study voluntarily.

**Study area and subjects**

This study was carried out among four rural primary school children at the Shimulpur, Salka, Kumarhut and Ramnagar Village, in the districts of 24 Parganas North & South, West Bengal, India. A total of 560 students aged 6–8 years (280 boys & 280 girls) participated in this study.

**Ethical consideration**

The study was approved by the Institutional Ethical Committee of All India Institute of Hygiene & Public Health, Kolkata, Ministry of Health & Family Welfare, and Govt. of India.

During the visits to the schools and the villages, community meetings were held in presence of the headmaster of the schools, the heads of the villages, the parents and their school-age children before commencement of the study. Informed written consent was obtained from mothers of the participants.

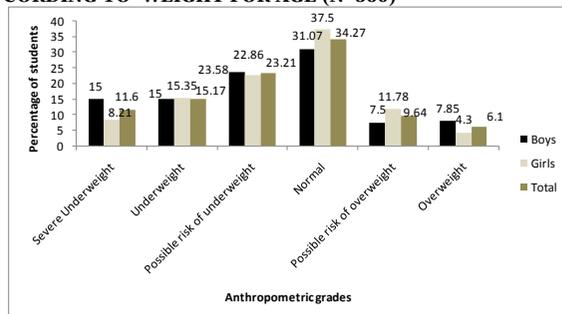
**Data analysis**

Statistical analysis of the data was performed using the Statistical Package for Social Sciences for Windows SPSS (version 21.0).

**RESULTS**

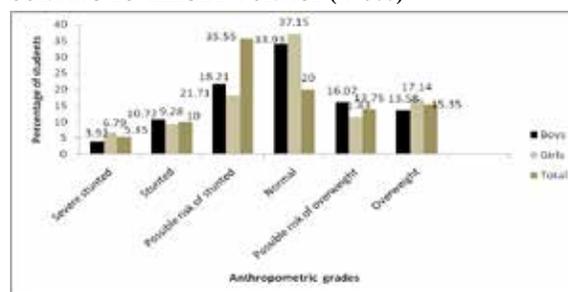
According to the weight for age, out of 280 boys 15% were severely underweight, 15% underweight, 31.07% normal, 23.58% at risk of possible underweight, 7.5% at risk of possible overweight and 7.85% overweight; out of 280 girls 8.21% were severely underweight, 15.35% underweight, 37.5% normal, 22.86% at risk of possible underweight, 11.78% at risk of possible overweight and 4.30 % overweight; out of total 560 school children 11.60% were severely underweight, 15.17% underweight, 34.28% normal, 23.21% at risk of underweight, 9.64% at risk of overweight and 6.10% overweight (Fig.1).

**Fig. 1: DISTRIBUTION OF THE SCHOOL CHILDREN ACCORDING TO WEIGHT FOR AGE (N=560)**



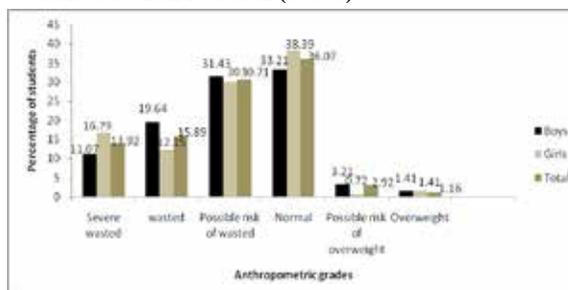
According to the height for age, out of 280 boys 3.92% were severely stunted, 10.72% stunted, 33.93% were normal, 21.71% at risk of possible stunting, 16.07% at risk of possible overweight and 13.58% overweight; out of 280 girls 6.79% were severely stunted, 9.28% stunted, 37.15% normal, 18.21% at risk of possible stunting, 11.43% at risk of possible overweight and 17.14% overweight; out of total 560 school children 5.35% were severely stunted, 10% stunted, 35.55% normal, 20% at risk of possible stunting, 13.75% at risk of possible overweight and 15.35% overweight (Fig. 2).

**Fig. 2: DISTRIBUTION OF THE SCHOOL CHILDREN ACCORDING TO HEIGHT FOR AGE (N=560)**



According to BMI for age, out of 280 boys 11.07% were severely wasted, 19.64% wasted, 31.43% at risk of wasting, 33.21% normal, 3.21% are at risk of possible overweight and 1.44% overweight; out of 280 girls 16.79% were severely wasted, 12.15% wasted, 30% at risk of possible wasting, 38.93% normal, 0.72% at risk of possible overweight and 1.41% overweight; out of 560 children 13.92% were severely wasted, 15.89% wasted, 30.71% at risk of wasting, 36.07% were normal, 2.92% at risk of possible overweight and 1.16% overweight (Fig.3).

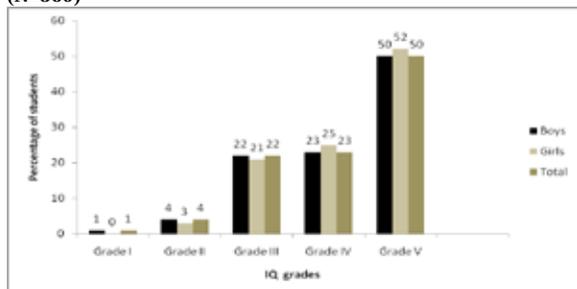
**Fig. 3: DISTRIBUTION OF THE SCHOOL CHILDREN ACCORDING TO BMI FOR AGE (N=560)**



According to the Raven Progressive Matrices test out of 280 boys 1%, 4%, 22%, 23% and 50% scored grade I, II, III, IV and V, respectively; out of 280 girls none scored grade I, grade II, III, IV and V scored by 3%, 21%, 25% and 52% girls, respectively; Out of total 560 school children 1%, 4%, 22%, 23% and 50% scored

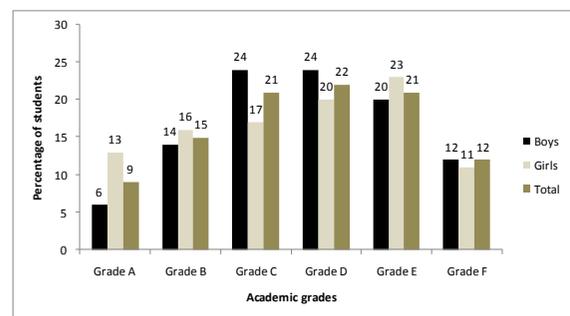
grade I, II, III, IV and V, respectively (Fig.4).

**Fig. 4: DISTRIBUTION OF THE SCHOOL CHILDREN ACCORDING TO THE RAVEN PROGRESSIVE MATRICES TEST (N=560)**



This study revealed that according to academic gradation out of 280 boys 6% obtained grade A, 14% grade B, 24% grade C, 24% grade D, 20% grade E & 12% grade F; out of 280 girls 13% obtained grade A, 16% grade B, 17% grade C, 20% D, 23% grade E & 11% grade F; out of total 560 children 9% obtained grade A, 15% grade B, 21% grade C, 22% grade D, 21% grade E & 12% grade F (Fig.5).

**Fig. 5: DISTRIBUTION OF THE SCHOOL CHILDREN ACCORDING TO ACADEMIC GRADATION (N=560)**



**DISCUSSION**

Present study revealed that 26.77%, 15.35% & 29.82% of the children were underweight, stunted and wasted, respectively. It was also observed that nutritional status of the girls was better in comparison to boys (Fig.1,2,3).

Prevalence of underweight and stunting among the children in the present study was lower in comparison to earlier studies in Puruliya district of West Bengal [19] and other neighboring states of India[20,21,22] among the children of same age group. However, proportion of severely underweight (11.6%) & stunted children (5.35%) observed in our study was higher than what was reported in the West Bengal study [23]. Measurement of BMI revealed that 29.82% of the total children were wasted while 13.92% of them were severely wasted (Fig.3). Wasting was more in boys (19.64%) in comparison to girls (12.14%). However, severe wasting was found to be higher in girls (16.78%) than boys (11.07%). A previous study [24] among school children of Bankura, West Bengal reported lower prevalence of wasted children (23.1%). Other studies [25,26,27] among the school children of Paschim Medinipur, Purba Medinipur & Purulia districts of West Bengal have reported higher prevalence of wasted children in comparison to the present study.

From all the three methods for assessing the nutritional status it appeared that under nutrition was highly prevalent among the school children under study and the boys were more affected than girls. It is interesting that while the prevalence of under nutrition was quite high among the study population some in-

dividuals were found to have overweight according to weight for age (6.07%), height for age (15.35%) and BMI (1.16%). Though the prevalence of overweight among the children was not very high but it indicates the co-existence of under nutrition and over nutrition even in the rural society.

Assessment of IQ of the children according to Raven Progressive Matrices test revealed an undesirable finding. 51% of them found to have lowest IQ grade (Grade V), only 1% student had the highest level of IQ (Grade I) and only 3% had Grade II level (Fig.4). Study revealed IQ level of the students were not optimum however, boys were having higher IQ grades than girls in terms of first three IQ grades.

Less than quarter (24%) of the school children under study were found to achieve either A or B grade in their academic activities, whereas 55% of them failed to achieve better than D grade (Fig.5). Girls achieved better in higher grades in comparison to boys. In case of combined lowest three grades, percentage of girls was lower (54%) than boys (56%). Results, therefore, indicate better educational status of the girls than boys in the study population. Girls' performing better academically than boys has been also been documented earlier [23].

No significant correlation exists between height for age and IQ of the children while significant ( $r = 0.122, p < 0.01$ ) positive correlation between height for age and academic grade of the children exists. Significant positive correlation ( $r = 0.094, p < 0.05$ ) also exists between BMI for age and academic grade of the children. However, no significant correlation exists between BMI and IQ of the children. Significant positive ( $r = 0.153, p < 0.01$ ) correlation between academic grade and IQ grade of the students exists.

**CONCLUSION**

Overall nutritional and academic status as well as IQ level of the primary school children under study is far from desirable.

Girls have better nutritional and academic status despite having lower intelligence level than boys.

Significant correlation between chronic malnutrition and academic performance but not with IQ level exists among the students.

Presence of overweight children in this area with high prevalence of under-nutrition may be due to lack of physical activity and effects of urbanization.

**ACKNOWLEDGEMENT**

The authors express their deep sense of gratitude to all the children, their parents and the authorities of the primary schools selected for the study.

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