A Study on Association between Nutritional Status and Simple Reaction Time in Rural Tribal Boys of South Tripura and their Impacts on Academic Performance

Prasanta Deb and Prakash Chandra Dhara

Abstract-The present study is aimed at assessment of Socio-economic status, anthropometric variables, nutritional status and psychomotor ability of tribal school going children of South Tripura. 391 Tripuri children (195 boys and 196 girls) subjects age ranging from 10 to 15 years from two sub-divisions of South Tripura namely Belonia and Santirbazar were selected for the study. The study is restricted to the anthropometric variables, socio-economic status by modified Kuppuswamy scale and reaction ability to measure the psychomotor ability of tribal school going children respectively. Association of anthropometric variables with socio-economic status, nutritional status and psychomotor ability of Tribal school children of South Tripura has been examined by using correlation technique. The nutritional status has been assessed by comparing with RDA (ICMR,2010), socio-economic status based on modified Kuppuswamy scale and psychomotor ability of Tribal School Children of South Tripura by comparing with percentile scale. Further, several studies showed the correlation between psychomotor ability with the level of intelligence which would certainly influence their educational quality.

Key words-Academic Performance, Anthropometric Variables, Level of Intelligence, Nutritional Status, Psychomotor Ability ,Socio-economic Status and Tribal Children.

I. INTRODUCTION

The Psychomotor Ability deals with physical and motor development. In the psychomotor domain we are providing opportunities to develop balance, eye-hand coordination, agility, flexibility, strength, reaction ability and other components of the domain. Reaction time is the interval between the onset of a signal (stimulus) and the initiation of a movement response [1].

Prasanta Deb, Assistant Professor, Department of Human Physiology, Swami Vivekananda Mahavidyalaya, Mohanpur, West Tripura, India.
Prakash Chandra Dhara, Professor, Department of Human Physiology with Community Health, Vidyasagar University, Midnapore, West Bengal, India

Development of the psychomotor domain can be important for the individual's health and well-being, as well as for that of the community. Reaction time refers to the time when the individual only reacts to a specific stimulus, such as when subjects must press a button hearing a voice or seeing a visual stimulus. Determination of reaction time is a valuable indicator for assessing the psychomotor ability. Several researchers have pointed out a significant relationship exists between IQ and reaction time. Reaction time was reported to influence the academic performance as well. The reaction time varies with age, gender, personality, learning disorders, distraction, drug addiction, physical activity, health related fitness,

socioeconomic status etc. which ultimately influences the psychomotor ability [2].

Very few literatures are available to define psychomotor ability in respect of nutritional status of school going children. With such background researcher was determine the relationships between selected psychomotor ability with nutritional status among tribal school going students. Possibly the result would be helpful to initiate intervention programs by the Government and other NGO's for the improvement of the nutritional status of the school going tribal students of South Tripura.

II. OBJECTIVES

1. The present study was carried out to assess the Socio-economic status, anthropometric variables, nutritional status and psychomotor ability of tribal school going children of South Tripura.
2. Association of nutritional status and psychomotor ability was determined.

III. METHODS AND MATERIALS

The cross-sectional study involved 391 healthy school children (195 Boys, 196 Girls) aged from 10 to 15 years living in rural areas of South district of Tripura. All children studying in class V to Class X were recruited from six schools, randomly selected from two sub-divisions Belonia and Santirbazar of the South district. Exclusion criteria included students who are not willing to participate in the study were excluded, students other than this age group were also excluded.

The study was carried out with written informed permission obtained from the Head of the Institution. The purpose and objective of the study was explained to the institutional head and teachers. Informed consent was obtained from the subjects and was as per the Helsinki declaration.

Socio-economic status was determined using modified Kuppuswamy's scale [3].

Different anthropometric measurements of the subjects were taken under standardized condition. The height was measured to the nearest 0.5 cm without shoes using a anthropometer with head in Frankfort plane and weight was recorded using a mechanical beam balance, and was recorded to the nearest 0.1 Kg, using standard technique [4]. The body mass index (BMI) of a subject was determined by dividing the weight (kg) by the squared value of height (meter).[BMI = weight / height^2]. Body mass index was calculated to assess whether they are obese, underweight or normal.

24-hours recall method : Dietary intake of 30 boys and 30 girls was conducted for Tripuri boys and girls for each age group 10 to 15 years by face to face interview based on 24 hour recall method [5]. Using the approximate amount of raw material that could go into the preparation of the cooked foods the amount of energy, protein and fats obtained per day from the foods consumed by the subjects was calculated based on the 'Nutritive value of Indian foods' [6]. The percent adequacy was computed for energy, proteins and fats with the help of recommended dietary allowances (RDA) for Indian by the ICMR expert group (2010) [7].

Per cent adequacy of food intake: Balance diet for children (8 to 15 years) recommended by ICMR- 2010 was used to analyse the per cent adequacy of food intake, calculation was done as follows:

Per cent adequacy of food intake = $\dfrac{\text{Food intake} \times 100}{\text{Recommended dietary intake (RDI)}}$

Nutrient intake: Nutrient intake was calculated using food composition tables [6]. Mean nutrient intake for one day was compared with recommended dietary allowances (ICMR - 2010) and per cent adequacy was calculated as follows:

Per cent adequacy of nutrient intake = $\dfrac{\text{Nutrient intake} \times 100}{\text{Recommended dietary allowance (RDA)}}$

BMI for age was also used for nutritional assessment.

Psychomotor ability was assessed by Nelson Hand Reaction Test to measure reaction ability and was recorded to nearest seconds [8].

Association of anthropometric variables, socio-economic status, nutritional status and psychomotor ability was determined using correlation technique. Further, to assess psychomotor ability of Tribal School Children percentile scale were used.

IV. RESULTS AND DISCUSSION

Table 1 : Distribution of Tripuri students with respect to age and gender

	Age (in years)	Male		Female		Total	
		N	%	N	%	N	%
TRIPURI STUDENTS	10	31	15.90	34	17.35	65	16.62
	11	31	15.90	30	15.31	61	15.60
	12	31	15.90	37	18.88	68	17.39
	13	34	17.44	33	16.84	67	17.14
	14	35	17.95	32	16.33	67	17.14
	15	33	16.92	30	15.31	63	16.11
	Total	195	100	196	100	391	100

Table 1 showed age wise distribution of male and female Tripuri students. A total of 391 students were selected by random sampling for the present study of which 195 were males and 196 were females.

In table 2 Mean±SD of different anthropometric variables were shown according to age and sex. No significant difference was observed between male and female subjects among the anthropometric variables. Boys showed slightly better mean values in comparison to girls.

Table-2: Anthropometric variables (MEAN ±SD) of Tripuri students

Table 3 showed that most of the children belonged to the lower socio-economic status

Socio-economic status	TRIPURI STUDENTS			
	Boys		Girls	
	N	%	N	%
Upper middle	11	5.64	08	4.10
Lower middle	24	12.31	23	11.73
Lower	160	82.05	165	84.18

Table 3 showed poor socio-economic status of Tripuri children as determined by modified Kuppuswamy's socioeconomic index. Parents of most of the students were forest dwellers and daily laborers, most of them had studied up to the primary and middle stage level (Shown in Table1). Similar finding were also reported by Deb and Dhara (2013) [9] .
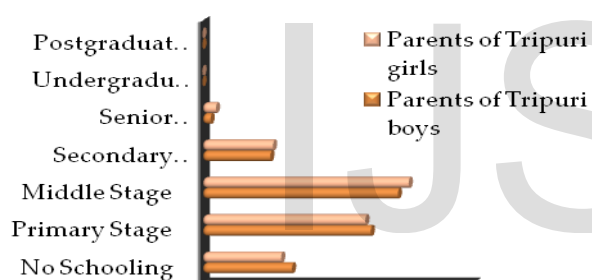
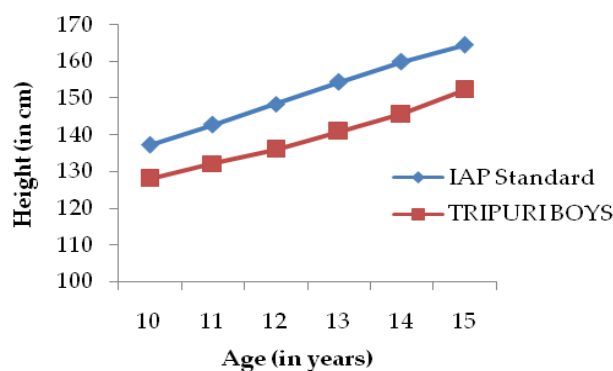Figure 1 : Educational Status of Parents of Tripuri Students

Fig. 2 Comparison of height of Tripuri boys with IAP Standard height

| Sl. No.	Age	Sex	Height (cm)	Weight (kg)	BMI (kg/m^2)
1	10+	Boys	127.9±0.83	23.68±0.47	14.44±0.16
		Girls	127.60±1.05	23.58±0.59	14.39±0.15
2	11+	Boys	132.32±0.71	26.03±0.48	14.82±0.14
		Girls	132.13±0.87	25.91±0.51	14.80±0.15
3	12+	Boys	136.96±1.17	28.83±0.56	15.33±0.16
		Girls	137.25±1.06	29.16±0.56	15.43±0.10
4	13+	Boys	141.86±1.01	31.66±0.73	15.67±0.20
		Girls	142.47±1.16	32.53±0.68	15.97±0.16
5	14+	Boys	145.25±1.62	35.05±0.75	16.57±0.14
		Girls	144.69±0.59	35.35±0.47	16.87±0.16
6	15+	Boys	151.98±1.14	39.59±0.79	17.11±0.23
		Girls	145.75±1.74	38.90±0.97	18.25±0.23
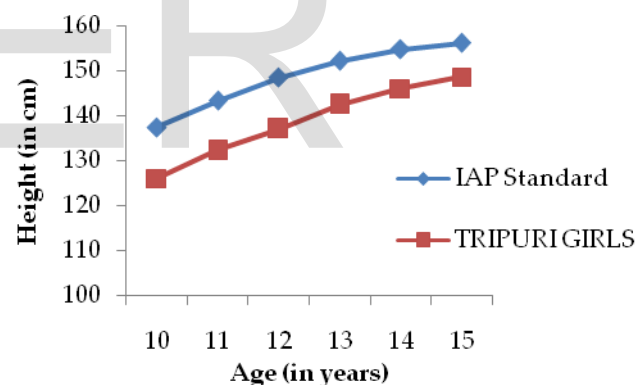
Fig 3 Comparison of height of Tripuri girls with IAP Standard height
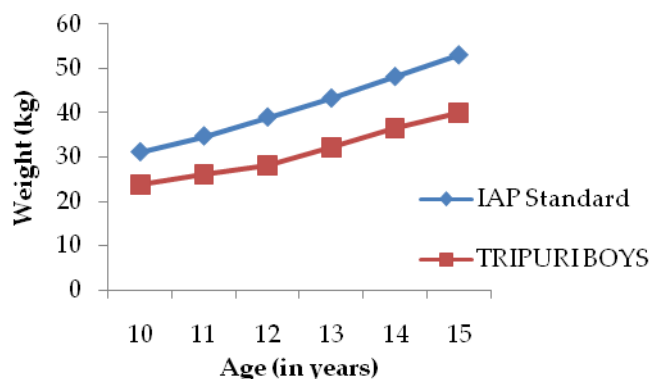
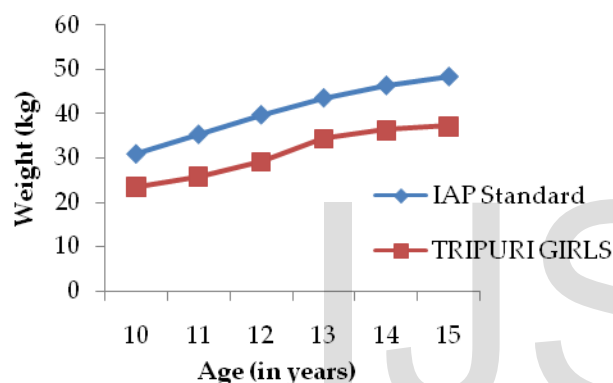Fig 4 Comparison of weight of Tripuri boys with IAP Standard height

Fig 6: Mean food intake per day by 10-12 years tripuri students

Fig 5 Comparison of weight of Tripuri girls with IAP Standard height
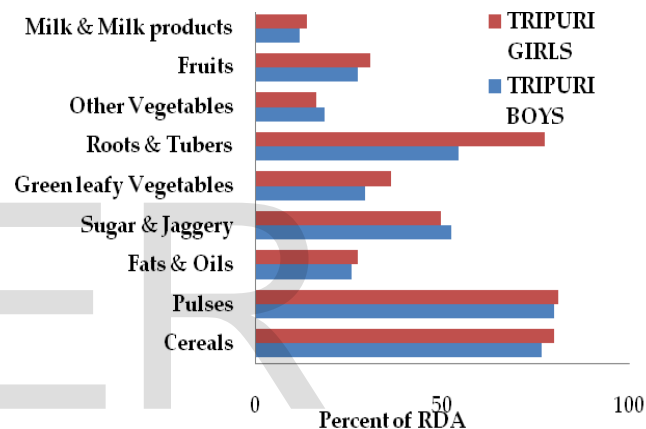
Fig 7: Food intake per day by 13-15 years tripuri students

Height and weight of Tripuri boys and girls were compared with Indian standard height and weight (IAP,2017) [10]. Both boys and girls showed the prevalence of stunting and underweight. This may be due to poor socioeconomic status, poor nutritional status and lower levels of physical activity.
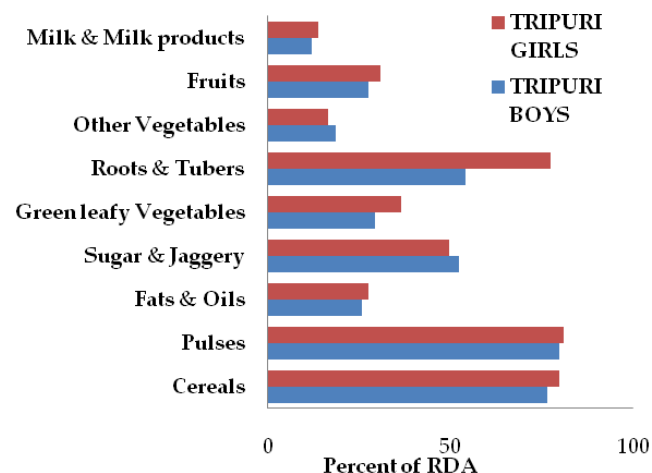
Figure 6 and 7 showed that the daily food intake by the Tripuri boys and girls of 10-12 years and 13-15 years age group was below than the recommended consumption values by ICMR,2010, this was revealed from the 24 hours recall method for diet survey analysis. Several studies reported lower consumption of food stuffs below as recommended by ICMR. In a study conducted by Ghosh and Pati (2015) on Santal-Munda tribal children of 24th Paraganas, West Bengal, India reported the existence of acute and chronic nutritional stress in the form of underweight, stunting , wasting and thinness indicating the requirement of appropriate public health nutritional intervention programme [11]. Bisai et al.,2008 showed the prevalence of undernutrition among Lodha children of 1 to 14 years children of Paschim Medinipur, West Bengal, India[12]. Deb and Dhara, 2013 also reported the prevalence of undernutrition among the Tripuri tribal school children of South Tripura. Singh and Mondal, (2013) had reported the prevalence of thinness among among the Sonowal Kachari children aged 6-18 years of Dibrugarh district of Assam, Northeast India [13].

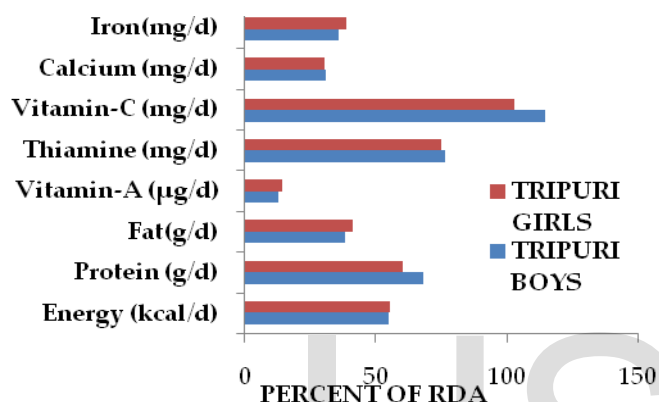| Variables	Distribution	No. of Subjects Male	% total	No. of Subjects Female	% total
Reaction Ability	Excellent (> 7.5 cm)	-	-	-	-
	Above Average (7.5 - 15.9 cm)	-	-	-	-
	Below Average (20.4 -28 cm)	58	29.74	45	29.80
	Poor (<28 cm)	137	70.26	151	77.04

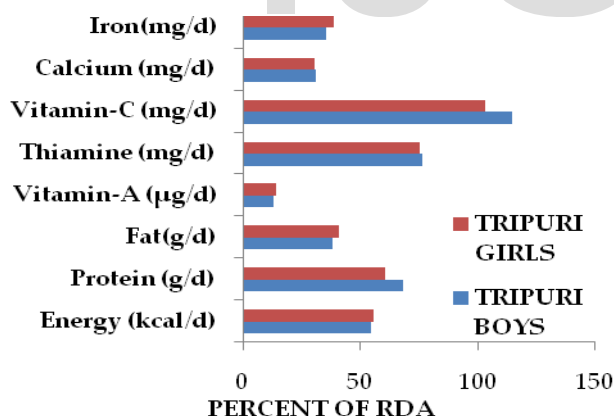Fig 8 Mean daily intake of nutrients as percent of RDA by 10-12 years tripuri students

Fig 9 Mean daily intake of nutrients as percent of RDA by 13-15 years tripuri students

Table 4 : Categorization of malnutrition based on BMI for age (WHO,2007)

Today, India has the highest level of child malnutrition after Bangladesh in South Asia. Malnutrition continues to prevail among the tribal students. UNICEF reported that India harbours one third of the stunted, wasted and malnourished children of the world. The recent study of Cole et al.,2007 has stated that undernutrition can be better assessed as thinness (low body mass index for age) than as wasting (low weight for height) [14]. Thinness has been assessed using the indicator BMI- for- age and compared with the z-score classification by WHO (2007) [15] .Based on BMI for age it has been found that more than half of the students were found to be malnourished.

Table 5 Criteria for rating reaction ability and results of measurement

Reaction ability of the Tripuri students was found to be in the "below average" and "Poor" status. Tripuri girls showed poor reaction ability in comparison to boys. Academic activities and learning involves skills which require the development of psychomotor abilities. From the present study it was clear that girls due to their less physical activities in comparison to boys developed poor skills which will certainly interfere with their academic performances. Thus, for better academic performances healthy and nutritious diet, physical activities and games and sports are also essential to remain fit, which would improve the psychomotor skills for better performances.

Types of malnutrition	N	Normal	Grade-I (Mild)	Grade-II (Mod.)	Grade-III (Mod.)	Total Malnourished
		No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
TRIPURI BOYS						
BMI (kg/m^2)	195	97 (49.74)	58 (29.74)	30 (15.38)	10 (5.13)	98 (50.26)
TRIPURI GIRLS						
BMI (kg/m^2)	196	103 (52.55)	57 (29.08)	31 (15.82)	05 (2.55)	93 (47.45)
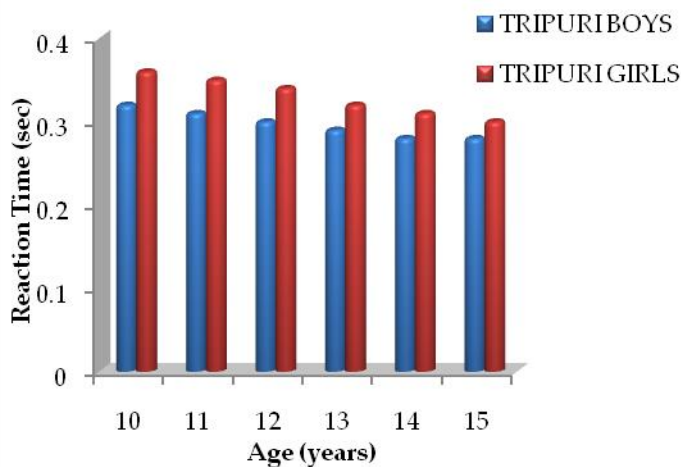
Fig 10 Comparison of reaction time in tripuri children

Girls showed significantly higher reaction time in comparison to boys (P<0.001). With increasing age the reaction time reduces in both boys and girls.
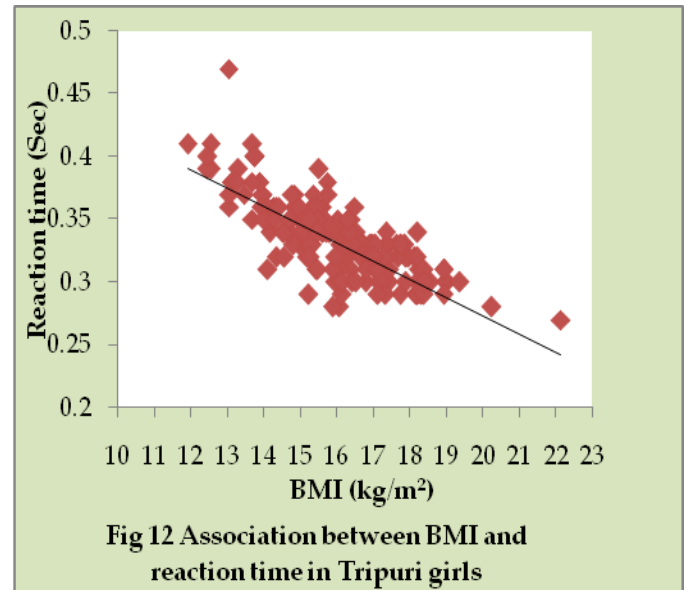

Fig 11: Association between BMI and reaction time in Tripuri boys

Fig 12 Association between BMI and reaction time in Tripuri girls

Table-6 : Correlations between BMI and Reaction time in Tripuri boys and girls

	REACTION TIME (in sec)	
BMI (kg/m²)	-0.756***	Tripuri Boys
	-0.560***	Tripuri Girls

***P<0.001
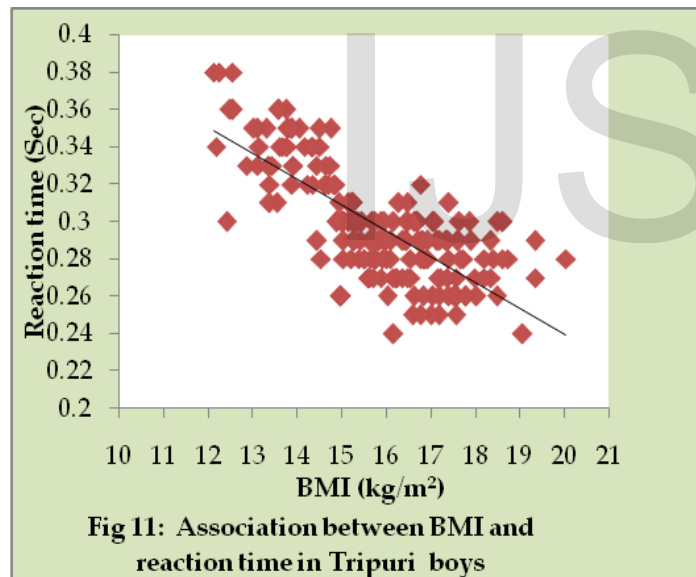
BMI showed negative correlations with reaction time in both boys and girls, thus with increase in BMI, reaction ability decreases. Increased BMI is an indicator for increased weight which would certainly due to less physical activities among the school going students. BMI within normal range is very important for better psychomotor ability, learning and healthy future life. Several studies reported the prevalence of obesity and early childhood hypertension among the school children with less physical activities and poor involvement in sports activities. Moreover, a positive association was reported by Saha (2014) between socio-economic status with health related physical fitness[16]. Thus, better economic condition promotes better health with better physical fitness.

In the present study under nutrition was prevalent (almost 50.0%) among the students but at the same time tendency of less physical activities among these students would certainly interfere with their academic as well as physical performances.

V. CONCLUSION :

The present study revealed that the Tripuri boys and girls of rural areas of South Tripura are undernourished. Furthermore, it was evident from the result that prevalence of stunting and wasting exists among the school students in comparison with IAP standards in India.

The strong degree of correlation between nutritional status and psychomotor ability (reaction time) was found from the study. Association of psychomotor ability with IQ and academic performance were reported by many researchers [17].

Nutritional status would certainly be a determining factor for psychomotor ability in addition to the other factors[18]. Thus, the present study would simply relates the importance of proper and adequate nutrition for better academic performance and this too from the very beginning of the childhood.

This study further demands the implementation of various intervention programs by the Governmental organizations to improve the nutritional status of the tribal children. Various NGOs may also be involved to impart nutritional education in rural tribal areas of Tripura.

VI. REFERENCES :

[1] R.A. Magill, *Motor Learning Concepts and Applications*, Boston, USA: McGraw-Hill, pp. 19, 1998.

[2] Bouchard and Shephard. "A Model Describing the Relationships between Physical Activity, Health-Related Fitness and Health," 1994.

[3] Gururaj and Maheshwaran, "Kuppuswamy's Socio-Economic Status Scale –A Revision of Income Parameter For 2014", *International Journal of Recent Trends in Science And Technology*, Vol.11, no.1, pp. 01-02, 2014.

[4] R.D. Lee, and D.C. Nieman, *Nutritional assessment*, New-York: McGraw Hill, 2003.

[5] M. Swaminathan, *Essentials of Food and Nutrition, Vol. I and II*, Bangalore :The Bangalore Printing and Publishing Co., Ltd., 2008.

[6] C. Gopalan, B.V. Rama Sastri and S.C. Balasubramanian, *Nutritive Value of Indian Foods*, Nutritional Institute of Nutrition, Indian Council of Medical Research, Hyderabad, 2004.

[7] Indian Council of Medical Research, *Nutrient Requirements and Recommended Dietary Allowances for Indians.* National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, 2010.

[8] B.L. Johnson and J.K. Nelson, *Practical measurements for Evaluation in Physical Education*, New Delhi: Surjeet Publications, 1986.

[9] P. Deb, and P.C. Dhara, "Anthropometric measurements and undernutrition: A case on School Children of South Tripura, India", *Journal of Life Sciences,* Vol.5, no.1, pp.47-51, 2013.

[10] V. Khadilkar, S. Yadav, K.K Agrawal, S. Tamboli, M. Banerjee, A. Cherian, J. P. Goyal, A. Khadilkar, V. Kumaravel, V. Mohan, D. Narayanappa, I. Ray and V. Yewale, "Revised IAP Growth Charts for Height, Weight and Body Mass Index for 5- to 18-year-old Indian Children", *Indian Pediatrics,* Vol.52, pp.47-55, 2015.

[11] J. Ghosh, and R.R. Pati, "Assessment of nutritional status among Santal-Munda tribal children in rural area of Amdanga block, North 24th Parganas District of West Bengal, India", *Int.J.Curr.Microbiol.App.Sci.,* Vol.4, no.7, pp. 810-814,2015.

[12] S.Bisai, K. Bose and A. Ghosh, "Prevalence of Undernutrition of Lodha Children Aged 1-14 Years of Paschim Medinipur District, West Bengal, India", *Iran J Pediatr.,* Vol.18, no.4, pp.323-329, 2008.

[13] J. Singh, and N. Mondal, "Assessment of Nutritional Status: A Case of Tribal Children in Assam, Northeast India", *J. Nepal Paediatr. Soc.,*Vol. 33, no.1,pp.1-7, 2013.

[14] T.J. Cole, K.M. Flegal, D. Nicholls, A.A. Jackson, "Body mass index cut offs to define thinness in children and adoles-cents: international survey",. *BMJ.* Vol.335, no.7612, pp.194, 2007.

[15] World Health Organization (WHO). Diet, nutrition and the prevention of chronic diseases : Report of a Joint WHO/FAO Expert Consultation. WHO Technical Report Series no. 916. Geneva : WHO, 2007.

[16] G.C. Saha, "Assessment of physical fitness, socio-economic and psychomotor ability", *Biology of exercise,* Vol.10, no.1, pp.41-51, 2014. http:doi.org/10.4127/ibe.2014.0072.

[17] G.N.O. Brito and M. de Onis, "Growth Status and Academic Performance in Brazilian School Age Children", *Arq Neuropsiquiatr,* Vol.64, no.4, pp. 921-925, 2006.

[18] M.M. Black, "Micronutrient Deficiencies and Cognitive Functioning", *Journal of Nutrition,* Vol.133,no.11,pp. 3927S – 3931, 2003.