MATHEMATICAL RELATIONSHIP AMONG AGE, BMI AND VISUAL REACTION TIME IN NORTHERN INDIAN CHILDRENS

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ABSTRACT

Reaction time has been defined as the time interval between the application of a stimulus and the response by the subject. Various factors affect reaction time like handedness, age and gender of the person, BMI, type of receptor system involved. It is well known that there exist relationship among Visual Reaction Time, age and BMI. The degree of correlation among these variables is found to be higher. In this paper we develop a multivariate regression line in the form of $z = ax + by + c$, where x, y are two independent variable (x=age, y=BMI) and z is the measure of visual reaction time.

Key Words: Visual reaction time, Correlation, Regression line

INTRODUCTION

Visual reaction time (VRT) is the time that elapses from the initiation of a stimulus until a response is achieved. Reaction is a purposeful voluntary response to external stimulus. There is certain time period between application of stimulus and appropriate motor response. Reaction time can be divided into three parts. The first part is perception time, the time for the application and perception of stimulus. Second part is decision time, which signifies time for giving a suitable response to the stimulus. The third part is motor time, which is the time for the compliance to the order received[1]. Reaction is a purposeful voluntary response to external stimulus. Reaction time is defined as interval of time between presentation of stimulus and appearance of appropriate voluntary response in a subject. Our emotions, attention, memories these and all added reaction we make are responses to stimuli which play upon us[2]. Thus it indicates the time taken by an individual to react to external stimulus[3]. One measure of information processing is reaction time and is used to judge the ability of the person to concentrate and coordinate. Many studies revealed that reaction time task is a good indicator of sensor motor performance of an individual, as the young individuals performed better in the reaction time tasks than elderly individuals who have the tendency to be more careful and monitor their responses more thoroughly. It is one of the important methods to study a person's central information processing speed and fast coordinated peripheral movement response. Many research works have been published on reaction time and it is reported that there are many factors on which the reaction time depends. Some factors are Age, BMI, Sex, Fatigue condition etc. But there are very few research works available on the development of mathematical models based on reaction time visual reaction time with respect to age, BMI, sex etc. The application of these models may be wide not only to predict or estimate the visual reaction time but also to know the contribution of these factors on reaction time.

MATERIAL AND METHODS

The study subjects were taken randomly from *Techno Academic School and integral Institute of Medical Sciences & Research, Lucknow* with a permission of Director/Principal .The inclusion criterion was all disease free normal children and young adults aged between 6 – 21 years. Before the collection of data it was insured that subjects had taken no medication while we excluded those children's who were any addiction such as smoking, tobacco

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or alcohol, any history of drug abuse and any history of hereditary or chronic illness. The total number of subjects was calculated by the help of statistician which was 104.The very common, efficient and easy machine "IM-CORP Ambala Reaction Time Instrument" was used to acquire the simple reaction time data in children. The Reaction Time tests consist of two colored lights (red & green) and two response buttons to which a digital timer is connected.

The specifications of reaction timer machine are,

1. Inbuilt chronoscope – 4 digit chronoscope with least count of 1/1000 seconds.
2. It works on – 230 volts AC.

Subjects were present randomly with two visual stimuli i.e. red & green light. The operating process was demonstrated priorly to reduce errors .Three readings of each stimulus noted after giving three practical trials and the lowest taken as the reaction time. The reaction time measured for both red and green colour. The process of pressing the buttons was explained to children to minimise the error.The study was cleared by the Institutional ethical committee.After the collection of data it was analyzed by using SPSS of version 20 to calculate descriptive statistics and regression constants.

RESULTS

The mean VRT score of green and red light was calculated. The average VRT (AVRT) is dependent variable in linear regression analysis while the age and BMI of children are independent variables. Table 1 shows the descriptive statistics. The average of average visual reaction time (AVRT) is 210.36 with standard deviation 62.53; the average age of children is 13.45 years with standard deviation 4.62 and means BMI is 145.78 with standard deviation 16.46.The mathematical linear relationship among variable is calculated as AVRT= -11.6 ×Age – 0.38×BMI + 423.The coefficient of determination (R^2) is 0.89.The high value of R^2 shows that the high degree of the data are to the fitted regression line is. The ANOVA obtained from regression analysis is found statistically significant (F=400.48, p <0.001) for predictors.

DISCUSSION

In the present study we developed a mathematical linear regression model in terms of VRT=a× Age+ b× BMI + C. The importance of this equation is inevitably. The above model may be used to forecast the reaction time score if the age and BMI of subjects are known. For example if the age and BMI of a child is 13 years and 146 cm^2/kg, the predicted VRT score will be -11.6 ×13 –

0.38×146+ 423 ≈ 217. A very few works are available regarding the development of these types of equations.

CONCLUSION

In this paper our finding is development of a mathematical linear model to forecast the visual reaction time for known values of BMI and age. The high value of R^2 supports the validation of model.

FUTURE WORK

In future work the same model will be developed for auditory reaction time (ART) In Northern Indian population with sufficiently large sample size.

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Table 1: Descriptive Statistics for variables under study

Variables	Mean ± SD
Average Visual Reaction Time	210.36±62.53
Age(Years)	13.45±4.62
BMI(cm^2/kg)	145.78±16.46

Table 2: Coreelation coefficient among variables under study

Variables	AVRT	BMI	Age
AVRT	1		
BMI	-0.80[*]	1	
Age	-0.94[*]	0.82[*]	1

*statistically significant as p< 0.05

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