



# RELATION AMONG AUDITORY REACTION TIME, AGE AND BMI: A STATISTICAL APPROACH

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## ABSTRACT

Reaction time (RT) is defined as the elapsed time between the presentation of a sensory stimulus and its behavioral response. Simple reaction time is usually defined as the minimum time required for an observer or subject to detect the presence of a stimulus. There are many research works on the visual reaction time and auditory reaction time to study the influence of various factors associated with them and found highly correlated to each other. But a very few works are there regarding the development of mathematical relationship in functional form. Therefore, in this paper we try to find out the degree of relationship among study variables and develop a statistical model by using multiple regression technique. The high value of coefficient of determination (R<sup>2</sup>) supports our model favorably.

**Key Words:** Auditory Reaction Time, Statistical Model, Correlation & Coefficient of determination

## INTRODUCTION

Reaction time (RT) is defined as elapsed time between the presentation of a sensory stimulus and its behavioral response. Simple reaction time is usually defined as the time required for an observer to detect the presence of a stimulus. Reaction time is the time interval between the application of a stimulus and the appearance of appropriate voluntary response by a subject. It involves stimulus processing, decision making, and response programming. Reaction time has been widely studied as its practical implications may be of great consequence e.g., a slower than normal reaction time while driving can have grave results [1]. It is a measure of function of sensor motor association [2] and performance of an individual [3]. It involves stimulus processing, decision making, and response programming. Reaction time studies have been documented in both sexes for visual and auditory stimuli. It has physiological significance and is a simple and non-invasive test for peripheral as well as central neural structures [4]. Reaction time provides an indirect index of the processing capability of CNS and it is a simple means to determine sensory motor performance, therefore, it represents the level of neuromuscular coordination via different physical, chemical, and

mechanical processes decodes visual or auditory stimuli which travel via afferent pathways and reach the brain as sensory stimuli [5, 6]. There are various factors that affect the reaction time to a stimulus. Factors like intensity and duration of the stimulus, age and gender of the participant, effect of practice can affect the reaction time of an individual to a particular stimulus. For example, there are relative differences between the reaction time to visual and auditory stimuli between genders [6].

In the present study we developed a mathematical model among age, BMI and average auditory reaction time (AART) which may be used to predict any variable if two of them are known. There are a very few models have been developed related to visual and auditory reaction time [7].

## MATERIAL AND METHODS

The study subjects in the present study were assigned randomly from Techno Academic School and Integral Institute of Medical Sciences and Research, Lucknow with a permission of director/principal. All disease free children's and young adults aged between 6 and 21 years

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subjects had taken no medication included in the study and while we excluded those children's who were any addiction such as smoking, tobacco or alcohol, any history of drug abuse and any past history of hereditary or chronic illness. The sample size was calculated by the help of statistician by using appropriate formula based on correlation between variables. The total number of subjects was 104. All the subjects were distributed in four age groups equally. The machine "IMCORP Ambala Reaction Time Instrument" was used to acquire the simple auditory reaction time data in children. The auditory reaction time was measured both for high and low pitch sound. Before collection of data all the study subjects were aware about the study. The data was collected for both high pitch and low pitch sound and then by averaging them we call it average auditory reaction time (AART).The data for variables gender, age and BMI were also obtained. The study was cleared by the Institutional Ethical Committee. After the collection of data it was analyzed by using SPSS of version 20, MS-Excel of version 7 and 3D function grapher of version 1.2. The descriptive statistics and correlation coefficient was calculated and multiple regression technique was used to develop a plane.

### RESULTS

The table 1 represents the descriptive statistics of Average Auditory Reaction time of children's. The mean age of subjects was 13.45 ( $\pm 4.62$ ) years, BMI was 17.16 ( $\pm 2.75$ ) kg/m<sup>2</sup> and AART was 189.77 ( $\pm 59.02$ ) milliseconds. The table 2 illustrates the correlation matrix among age, BMI and ART. Table 2 shows the Pearson correlation coefficient among variable. The negative value shows the negative correlation while positive value shows the positive correlation. The correlation coefficients between variables associated with p-value <0.05 is assumed to be significantly correlated.

The most important finding in this paper which was primary object is to develop a mathematical model  $Z = -11.77 \times \text{Age} - 0.67 \times \text{BMI} + 359.9$ .The utility of this model is inevitable [7]. The coefficient of determination (R<sup>2</sup>) associated with model is 0.89 which is significantly high (p<0.001) which strongly supports about being best fit of this model. A graph was developed by the help of 3D Function grapher software of version 1.2 for developed model which is shown by figure 1.

### DISCUSSION

In the present study we developed a mathematical model in terms of AART, Age & BMI. The importance of this model is inevitably. The above model may be used to es-

timate the auditory reaction time score if the age and BMI of subjects are known .Reaction times are widely used to evaluate neuromuscular-physiological responses in sports, to assess the IQ of children's and other psychometric studies where these types of model have great values.

### CONCLUSION

In this paper an attempt was made for the development of a mathematical model to forecast the auditory reaction time for known values of BMI and age. The high value of R<sup>2</sup> significantly supports the validation of model.

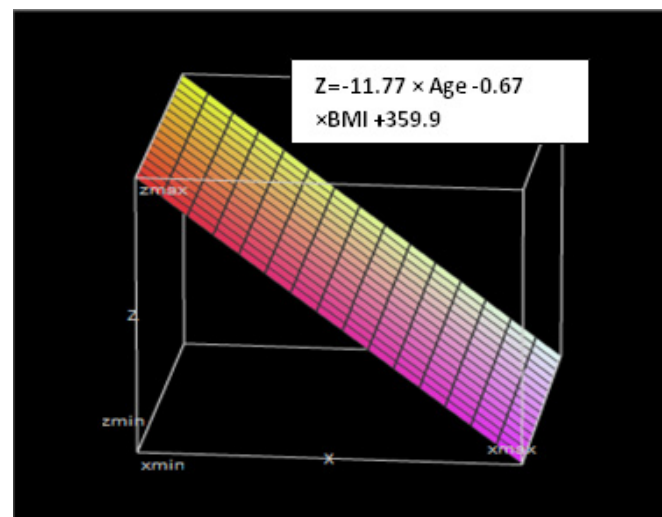
**Table 1: Descriptive Statistics of variables under study.**

Variables	Mean $\pm$ SD
Age (In years)	13.45 $\pm$ 4.62
BMI (Kg/m <sup>2</sup> )	17.16 $\pm$ 2.75
AART (Milliseconds)	189.77 $\pm$ 59.02

**Table 2: Correlation Matrix among Variables under Study.**

	AART	Age	BMI
AART	1	-0.93*	-0.51*
Age		1	0.52*
BMI			1

\*p< 0.05, correlation coefficients represents Pearson correlation coefficient



X-Axis is Age, Y-axis is BMI

**Figure 1:** 3-D plane

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