



## EFFECT OF BODY MASS INDEX ON SIMPLE AUDITORY REACTION TIME

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### ABSTRACT

**Back ground :** Reaction Time measurement constitutes a simple, non-invasive tool for assessing peripheral and central neural structures, thereby gaining physiological importance. Auditory Reaction Time is defined as the time interval from the execution of an auditory stimulus to the occurrence of suitable appropriate voluntary response as swiftly as possible. It is a measure of sensorimotor association. It calculates the alertness of a person - how rapidly a person reacts to a stimulus. The aim is to study the effect of Body Mass Index on Auditory Reaction Time in adults.

**Materials & Methodology:** A sample of 200 subjects were selected by purposive sampling method for the study. The study subjects included were those in the age group of 21-40 years of which 67 were with normal BMI, 67 were overweight and 66 were obese based on WHO classification. Auditory reaction time was recorded using Direct RT software.

**Conclusion:** In our study a significant difference is observed in ART between normal Body Mass Index, overweight and obese subjects. This could be due to the regions of the brain involved in cognition, reasoning, memory, processing speed, sensorimotor performance and attention are influenced by BMI and also abnormal levels of adipokines result in disrupted myelination.

**KEYWORDS :** Auditory Reaction Time, Body Mass Index

### INTRODUCTION

Obesity is a complex condition which has social and psychological dimensions affecting all age groups. It is a major contributor to the global burden of chronic diseases with increasing morbidity. The increasing prevalence of obesity has been attributed to rapid urbanisation, nutrition transition and reduced physical activity (Lal, S., Adarsh, Pankaj, 2011). The impact of obesity on various determinants of health is enormous. When compared to people with normal BMI, obese people have higher rate of absenteeism from work and take more disability leave thus decreasing productivity (Tucker, L.A., 1998). The aim of the study is to know if the increased BMI affects the reaction time of an auditory stimulus. Reaction Time is crucial for our day to day life. Intact sensory system, cognitive processing and motor performance are essential for it. It denotes the alertness of a person and the rapid response to a stimulus is based on his reaction time. Therefore it must be faster in certain occupations like Drivers, Doctors, Pilots, Nursing staffs, Military people, Security guards and Sportsmen where alertness is essential for society (Anupama, B., et al., 2014).

Auditory Reaction Time is defined as the time interval from the execution of an auditory stimulus to the occurrence of suitable appropriate voluntary response as swiftly as possible (Gandhi, Gokhale, Mehta & Shah, 2013). It is a measure of sensorimotor association. It calculates the alertness of a person - how rapidly a person reacts to a stimulus.

Reaction Time measurement constitutes a simple, non-invasive tool for assessing peripheral and central neural structures, thereby gaining physiological importance. (Namita, Ranjan & Shenvi, 2014) Reaction Time can be divided into three parts. The perception time, decision time and motor time. PERCEPTION TIME, the first part, is the time for the application and perception of stimulus. DECISION TIME or COMPREHENSION TIME the second part signifies the time for understanding the type, duration and direction of the stimulus. The third part is MOTOR TIME, that is the time for the compliance to the order received (Anupama, B., et al., 2014).

Stimulus → receptor → afferent → integrator → efferent → effector → Response.

The stimuli could be auditory, visual or tactile and the integrator may be the spinal cord or brain (Gandhi, P., et al., 2013). Reaction Time is influenced by multiple factors like the arrival of the stimulus at sensory receptor, conversion of the mechanical stimulus by the sensory receptor to a neural signal, neural transmissions and signal processing, muscular activation, soft tissue compliance, and also the selection of an external measurement parameter (Pain M, Hibbs A., 2007).

### AIM AND OBJECTIVES

To study the effect of Body Mass Index on Simple Auditory Reaction Time in adults.

### MATERIALS AND METHODS

This study was done in Department of Physiology, Coimbatore Medical College, Coimbatore. The study period was three months, from June 2016 to August 2016. A sample of 200 subjects were selected by purposive sampling method for the study. The study subjects included were those in the age group of 21-40 years of which 67 were with normal BMI, 67 were overweight and 66 were obese based on WHO classification. Alcoholics, smokers, those having clinical evidence of any central nervous system disorder or Psychiatric disorder or any muscular weakness, Peripheral neuropathy, On chronic medications, Systemic illness such as Diabetes Mellitus, Hypertension and Thyroid disorders were excluded from the study.

A proforma was used to collect information regarding age, sex, height, weight, with further details of alcohol intake, smoking, diet, drug intake, auditory disturbances, occupation and education. DIRECT RT (version 2014) software was used to record Auditory Reaction Time.

The study was carried out after detail explanation of the procedure and obtaining informed oral consent. Rinne's test and Weber's test (Pal, G.K., Textbook of Medical Physiology, 2013) were done to rule out any auditory disturbances in selected subjects. The height of the subjects was measured in centimeters using stadiometer in erect posture. The weight of the subjects was measured in kilograms using a standard weighing machine with their arms relaxed at their side with both feet together.

BMI was calculated using the quetelet's index.  
 $BMI = \text{weight in Kgs} / \text{height in meters}^2$

A thorough clinical check up with general and systemic examination including the respiratory, cardiovascular, abdomen and central nervous system were done.

### PROCEDURE FOR RECORDING AUDITORY REACTION TIME :

The subjects were made to sit comfortably and the procedure was explained to them. The procedure was carried out in a sound treated room with adequate light. The test was done using DIRECT RT software. The testing procedure was quite simple, noninvasive and harmless to the participants. A 1000 Hz beep sound was presented at random intervals to the participants ear through a head phone and the subject pressed the space bar of the system that is placed in front of them as per the given instruction. Care was taken to make the subject

sit comfortably and the dominant hand to be used to press the space bar after resting on the table and properly supported. It was instructed to keep the hand ready in front of the space bar and the subject pressed the space bar with their index finger as soon as he / she heard the beep sound. Adequate trials were given to the subjects so as to alleviate their anxiety. The minimum, maximum and the mean of the auditory reaction were recorded using the DIRECT RT software in milliseconds. The test was done during morning between 9am to 11am for all the subjects after breakfast.

The readings obtained were entered in Microsoft Excel 2007 data sheet and was analysed using XLSTAT 2014 Statistical Software.

## RESULTS:

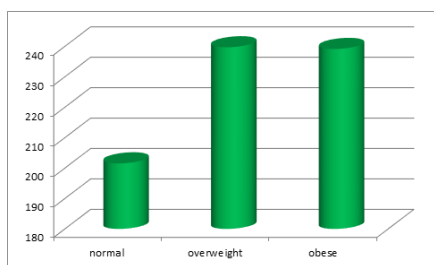
The mean age group of the study subjects was  $36.550 \pm 8.369$  years. Among the study group 148 (74%) were males and 52 (26%) were females. The mean Auditory Reaction Time in the study group recorded was  $207.990 \pm 38.336$  msec.

**Table 1. Comparison Of Art And Bmi.**

S.NO	BMI	ART (msec)	K VALUE <sup>†</sup>	P VALUE
1	Normal	201.542±0.511	13.771	0.001*
2	Overweight	239.700±42.957		
3	Obese	239.143±42.831		

\*significant, † Kruskal Wallis Test

Table 1. shows that there is a significant difference between normal, overweight and obese in Simple Auditory Reaction Time. The Simple Auditory Reaction Time in normal BMI subjects is shorter than compared to overweight and obese subjects.



**Fig.1. Simple Auditory Reaction Time and BMI**

## DISCUSSION:

Nikam LH et al.(2012), Simran Grewal et al,(Grewal,S.et.al.2012) showed a positive relationship between Reaction Time and Body Mass Index whereas Gitesh Dubal (Dubal et al., 2013) reported a negative correlation which was not explained. Body Mass Index influences the sensory motor coordination. Nikam LH et al.(2012) studied the effect of age, gender and Body Mass Index on Auditory Reaction Time and concluded that BMI, ART and VRT were significantly higher in older age groups and females having longer reaction time than males. Since females had higher BMI they had longer reaction times than males. They also proved a significant positive correlation between BMI and reaction time.

Various neurophysiological studies have shown that the regions of the brain involved in cognition, reasoning, memory, processing speed, sensorimotor performance and attention are influenced by BMI. The increased sensory threshold and slowing of nerve conduction in obese has been proved by nerve conduction studies.

Various pathophysiological changes including vascular changes, systemic inflammation, impaired insulin regulation can influence executive function via the vascular pathway. It is also suggested that adipose tissue secretes various cytokines, chemokines and tumour necrosis factors that cross the blood brain barrier and may alter the brain functions. Abnormal levels of adipokines result in disrupted myelination that alters the axonal conduction. Hence neuronal and myelination abnormalities along with axonal degeneration might be the cause for an increased reaction time in obese subjects (Grewal,S.et.al.(2012). Nene AS.et al.,(2010) DN Deore (2012). It has been reported that Auditory Reaction Time is increased in subjects with higher and also with lower BMI than normal. (Aiesha Durrebar Younus Khan, Amalladonna Ashwini & Basavaraj Malipatil, 2015)

## CONCLUSION

In the present study the simple auditory reaction time is slower in overweight and obese subjects compared to the people with normal Body Mass Index. This implicates the importance of maintaining the normal BMI thereby reducing the reaction time which is essential for certain occupations like drivers, military people, doctors, pilots etc. and also for some day to day activities like response to door bell, telephone ring or whistle of pressure cooker.

## References

- Lal,S.,Adarsh,Pankaj (2011).Textbook of community medicine.CBS Publishers(3rd ed.,pp.571-572)
- Tucker,LA.,Friedman GM.,(1998) obesity and absenteeism:an epidemiological study of 10,825 employed adults. Am J Health Promot.,12(3),p.202-207.
- Anupama, B., Sangeeta, V., Jitendra, G., Kapil, G., and Rinki, H. (2014) A comparative study between young and elderly Indian males on Audio-Visual Reaction Time. Ind.J.Sci.Res.and Tech,2(1),p.25-29.
- Gandhi, P., Gokhale, P., Mehta, H. and Shah, C. (2013). A comparative study of simple auditory reaction time in blind (congenitally) and sighted subjects. Indian Journal of Psychological Medicine, 35(3), p.273.
- Namita, N., Ranjan, D., & Shenvi, D. (2014). Study of auditory & visual reaction time between different professionals (resident doctors, staff nurses & security guards) during shift working in k. E. M. Hospital. Journal Of Evolution Of Medical And Dental Sciences, 3(71), 15104-15112. doi: 10.14260/jemds/2014/4033
- Pain, M., & Hibbs, A. (2007). Sprint starts and the minimum auditory reaction time. Journal Of Sports Sciences, 25(1), 79-86. doi: 10.1080/02640410600718004
- Pal,GK., (2013). Textbook of Medical Physiology (2nd ed., p. 992), Ahuja publishing house.
- Nikam, L., Gadkari, J. Effect of age, gender and body mass index on Visual and Auditory Reaction times in Indian population. (2012). Indian J Physiol Pharmacol., 56(1), 94-99.
- Grewal, S., Walia, L., Gupta, V., Sekhon T. Assessment of auditory and visual reaction time in healthy obese individuals. (2012). Journal Of Advance Research In Biological Sciences., 5(1), 32-36.
- Dubal, G., Bhabhor, M., Vidja, K., Jani, H., Kathrotia, R., & Kotadiya, F. (2013). A comparative study of simple auditory reaction time between male congenital full blind and sighted control. IJABMS.
- Nene, A., Pazare, P. A Study of Auditory Reaction Time in Different Phases of the Normal Menstrual Cycle. (2010). Indian J Physiol Pharmacol., 54(4), 386-390.
- Deore, D. (2012). A Cross Sectional Study on the Relationship Between the Body Mass Index (BMI) and the Audiovisual Reaction Time (ART). JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. doi: 10.7860/jcdr/2012/4440.2534
- Aiesha DurrebarYounus Khan, Amalladonna Ashwini, & Basavaraj Malipatil. (2015). Effect of Body Mass Index and Gender on Visual and Auditory Reaction Times in Young Adults. Journal Of US-China Medical Science, 12(2). doi: 10.17265/1548-6648/2015.02.004