SHORT COMMUNICATION

A STUDY OF RELATION BETWEEN BODY MASS INDEX AND SIMPLE REACTION TIME IN HEALTHY YOUNG FEMALES

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Abstract: Reaction time is an indirect index of processing capabilities of the central nervous system. The present study was carried out to determine if there is any influence of body mass index on simple reaction time in healthy young females. In this study, 60 young female participants were allotted to one of the three anthropometric groups based on their body mass index (BMI). Their reaction time to auditory as well as visual stimuli was recorded. Results were expressed as mean, standard deviation and data was analyzed using one-way ANOVA with post-hoc Tukey’s HSD test. Visual as well as auditory reaction time was longer in subjects having higher and lower BMI than normal. Visual reaction time was significantly longer in subjects with lower BMI as compared to that of subjects with normal BMI (P<0.05). Thus body mass index of an individual affects sensory motor association.

Key words: simple reaction time, body mass index

INTRODUCTION

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 & response programming. Reaction time is found to be altered by a number of factors both physiological and pharmacological (1, 2). There is growing evidence that overweight & obesity, indicated by body mass index have been found to be associated with a host of medical conditions, like cardiovascular, pulmonary, and endocrine diseases. Neurophysiological studies have shown that BMI, calculated as weight (in kg) divided by height squared (m²) influences cognitive function, attention & memory (3, 4). This provides a possible physiological explanation for BMI influencing reaction time. This study is an effort to assess whether BMI is associated with any alteration of simple auditory & visual reaction time in healthy individuals.
female students within age group of 17–20 years.

MATERIAL AND METHODS

The study was conducted in the Department of Physiology, Topiwala National Medical College & B.Y.L. Nair Hospital, Mumbai. Approval for the study was taken from the Institutional Ethical Committee. The study involved 60 female volunteers comprising of medical & paramedical students within age group of 17–20 years.

Height and weight were recorded at the clinical examination. Weight was recorded without shoes & with light clothes on an Equinox mechanical scale (model: BR 9015) with a least count of 500 gms. Standing height was recorded without shoes and with light clothes on a wall mounted measuring tape to the nearest of centimeters. These data were used to calculate BMI by formula

\[ \text{BMI} = \frac{\text{weight (kg)}}{\text{height}^2 \text{ (m}^2) } \]

Categorization of BMI was done according to WHO criteria and study subjects were divided into 3 groups:

- **Group I : BMI = 18.5–24.99**, normal weight;
- **Group II : BMI < 18.5**, underweight;

Subjects on psychotropic drugs (sedatives, hypnotics, and tranquilizers), anti-histaminics and anti-epileptics were screened & excluded from the study. Also volunteers known to be consuming alcohol or tobacco in any form & those with history of psychiatric illness or recent psychological trauma or sleep disorders were not included in the study. All the subjects were asked to have adequate sleep at night & to refrain from any medications throughout the study period.

Simple Reaction time was recorded with the help of an audiovisual reaction time apparatus (RTM-608, supplied by Biotech India, Mumbai). For simple auditory reaction time (ART) moderate pitch sound (4000 Hz) was used. Headphone was provided for clarity of sound and for simple visual reaction time (VRT) red light was used. All subjects were made familiar with the apparatus in advance. The tests were carried out in a secluded room in sitting position between 8:00 am to 10:00 am. Three practice trials were given every time before recording reaction time. The subjects were aware about the type of stimulus being presented & they were asked to respond immediately on hearing the sound (on seeing the light by pressing an appropriate button on subject’s panel with index finger of their dominant hand. Reaction time was read directly from digital display.

The statistical analysis was performed using SPSS package (version 16.0). The results were expressed as mean, standard deviation, & data was analyzed using one-way ANOVA with post-hoc Tukey’s HSD test, ‘P<0.05’ was taken as cut off for the measure of significance.

RESULTS

In the present study Body Mass Index was significantly different among the three study groups (Table I).

There was prolongation of ART in underweight as well as overweight subjects
condition that the subject has been instructed to respond as rapidly as possible, it evaluates the processing speed of CNS and the coordination between the sensory & motor systems (6). This study was carried out to find if there is any influence of body mass index on simple reaction time in young females.

Reaction time measurement includes the latency in sensory neural code traversing peripheral and central pathways, perceptive and cognitive processing, a motor signal traversing both central and peripheral neuronal structures and finally the latency in the end effector activation (i.e. muscle activation) (7). So any change in reaction time indicates presence of a peripheral and/ or central disturbance.

In this study, we found that in underweight subjects both visual as well as when compared to normal subjects, result being statistically not significant (Table II).

Prolongation of VRT was seen in underweight as well as overweight subjects when compared to normal subjects, result being statistically significant for underweight group (Table II).

**DISCUSSION**

Overweight and obesity, indicated by body mass index have been found to be associated with a host of medical conditions. Neurophysiological studies have shown that the brain regions involved in cognition, memory, vocabulary, speed processing and reasoning are influenced by BMI (5).

Since simple reaction time is the time interval between the onset of the stimulus and the initiation of the response under the condition that the subject has been instructed to respond as rapidly as possible, it evaluates the processing speed of CNS and the coordination between the sensory & motor systems (6). This study was carried out to find if there is any influence of body mass index on simple reaction time in young females.

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In this study, we found that in underweight subjects both visual as well as
auditory reaction times were longer when compared with normal weight group, the difference being statistically significant only for visual reaction time.

This finding of the association between underweight subjects and longer visual reaction time is novel. Previous studies have shown poor cognition in underweight persons and it has been attributed majorly to preclinical dementia (8). Another hypothesis put forward to explain this is dysregulation in hormone secretion corresponding to that in anorexia (9). Mechanisms underlying the cumulative effects of underweight on processing capabilities of the central nervous system would be an important topic for future research.

In overweight subjects both visual as well as auditory reaction times were longer when compared with normal weight group, though the difference was not statistically significant. Similar study by Skurvydas A. et al showed longer reaction time in overweight subjects where they studied reaction time in young males (9).

Different neurophysiological studies have shown influence of obesity and elevated body mass index on cognitive functions, memory deficits and executive dysfunction in young as well as middle aged individuals (4, 5, 9, 10). This has been attributed mainly to obesity induced vascular disease. Another mechanisms suggested are secretions of adipose tissue like hormones, cytokines, growth factors affecting brain health (8). In our study reaction time was longer in overweight subjects though not statistically significant. This factor may become significant with further increase in BMI.

Conclusion

Thus we conclude that body mass index of an individual influences simple reaction time, which is an indirect measure of sensory-motor association. Consideration of the body mass index of the participants prior to assessing the simple reaction time is recommended.

REFERENCES